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GOBEIL (A. R.). **Forest Entomology. Fifth annual Report for the Year ending March the 31st, 1942.**—*Rep. Dep. Lds For. Quebec 1941–42* repr. 15 pp., 1 fig., 2 refs.; also as *Contrib. For. Prot. Serv. Quebec* no. 18, 15 pp. Quebec, 1943.

This report on work in Quebec contains a brief review by R. Lambert (pp. 5–7) of the results of the forest insect survey in 1941 [*R.A.E.*, A **31** 348], and a tabulated record by M. E. Genest (pp. 8–9) of the insects found in inspections of permanent sample plots, plantations and tree nurseries, showing the severity or otherwise of the infestations.

R. Martineau (pp. 10–11) gives an account of the beginning of work on a project for studying the factors that affect insects in cut over areas, which serve as centres of infestation by bark-beetles and wood borers, and the reason why Longicorns develop rapidly in some burnt areas and not in others. Permanent sample plots were established for this work during the year in stands of conifers in the Laurentides National Park and in the Gaspé Peninsula. The treatments applied in stands felled in the previous year comprised the shading of slash stumps and logs exceeding 3 ins. in diameter by covering them with branches of balsam [*Abies balsamea*] and spruce [*Picea*], barking slash of this size so that the borers would have to establish themselves in slash of smaller dimensions or outside the treated area, and piling the branches, logs and tops in separate heaps. *Monochamus* sp. and *Dendroctonus piceaperda*, Hopk., were found to be generally present in logs and large branches, but the latter, contrary to expectations, was more abundant in the National Park than in the Gaspé Peninsula where it had caused serious damage in 1931–34. No notable influence due to treatment was observed at the end of the year. The burnt areas selected for study were one of black spruce [*P. mariana*], jack pine [*Pinus banksiana*] and balsam that was burnt over in 1941 and in which, five months later, most of the spruce and pine trees were covered with galleries extending into the wood; a second of black spruce and balsam visited by fire in June 1941, in which insects were less numerous, though the spruce showed signs of exterior attack; and a third of spruce and balsam destroyed by fire in August 1940, in which there was practically no insect damage. *M. scutellatus*, Say, was the most injurious species, but its life-cycle occupies more than one year, and no adults emerged in 1941. The larva first tunnels in the bark and continues its gallery inside the wood, near the heart of the tree, and extends it to the exterior. Jack pine and spruce were most commonly affected.

An investigation on the influence of climate on the development of the spruce sawfly, *Gilpinia hercyniae*, Htg., based on the date of cocoon formation of larvae in samples received from different parts of the Province was continued [*cf.* **31** 285, 461] and is summarised by G. Paquet (p. 12), who also states, in an account of work on the biological control of this sawfly (pp. 12–13) that *Microplectron fuscipenne*, Zett., was recovered in 1941 from cocoons collected in part of the Laurentides Park in which it had been liberated previously.

DE SANTIS (L.). **Sinopsis del género *Physcus* Howard con descripción de una especie nueva (Hym., Chalcidoidea).**—*Rev. Fac. Agron. La Plata* (3) **24** (1939) pp. 29–44, 4 figs., 37 refs. La Plata, 1940. [Recd. 1944.]

This paper includes a key to the species of *Physcus*, a list showing their hosts and distribution, and descriptions of both sexes of *P. flavoflagellatus*, sp. n., reared from *Chrysomphalus paulistus*, Hemp., in Santa Fe, Argentina. Little is known of the biology of most of the Aphelinids of this genus, except that they are primary parasites of Coccids of the tribes DIASPIDINI and ASPIDIOTINI, but Taylor, in work already noticed [*R.A.E.*, A **23** 279], has shown that the males of *P. varicornis* var. *intermedius*, Gah., are parasitic on females of their own species [*cf.* also **24** 664; **31** 22].

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Report of the Waite Agricultural Research Institute, South Australia 1941–1942. —84 pp., 2 pls., 1 map. Adelaide, 1943.

A section of this report (pp. 30–36) dealing with work on insect pests in South Australia in 1941 and 1942 also contains a summary of the results of studies on the bionomics and ecology of *Austroicetes cruciata*, Sauss., throughout its range in Australia [*cf.* *R.A.E.*, A **31** 349, 423 ; **32** 90, 299].

In connection with investigations on weevils that infest grain stored in bags in stacks in South Australia [**32** 313], three experimental stacks, each 12 × 12 × 12 ft. and containing 480 bags of wheat, were set up in May 1941 for studies on the environment produced in them. The initial moisture content of the wheat in all the stacks was 11·5 per cent., but 160 bags containing wheat with a moisture content of 15 per cent. were placed at the centre of the second, and 70 bags heavily infested with *Calandra oryzae*, L., at the centre of the third. The results are given of observations on the temperature in the first and third stacks, the moisture content of the wheat in the first, and the carbon dioxide content of the intergranular air in all of them. The temperature of the intergranular air at a depth of 1 in. followed daily fluctuations in that of the air outside. At a depth of 6 ft. in the first stack, it averaged 10°F. below that in the outer bags, but varied only with seasonal changes in outside temperature. It was about 65°F. during the summer of 1941–42. Temperatures in the third stack were higher owing to weevil activity and fluctuated about an average of 70°F. throughout the year at a depth of 6 ft. The carbon dioxide content of the intergranular air of the uninfested stacks was about the same as that of normal atmosphere (0·03 per cent.), but in the infested stack it rose to 0·4 per cent.

In 1942, the influence of these physical conditions of environment on the multiplication of *C. oryzae* and *Rhizopertha dominica*, F., was studied. Wheat was found to be more favourable for oviposition by *C. oryzae* when the moisture content was 15 per cent. than when it was 12 or 20 per cent., the most favourable temperature was 29°C. [84·2°F.], and the most favourable density was one adult per 50 grains. Oviposition did not occur at temperatures below 13°C. [55·4°F.] or above 35°C. [95°F.], or in wheat with a moisture content of 8 per cent. or lower. A few eggs were laid in wheat with a moisture content of 9 per cent. at temperatures above 25°C. [77°F.]. The eggs hatched at 13°C. and at 34°C. [93·2°F.] and development from egg to adult was completed at 15°C. [59°F.] and 34°C. but only 33 per cent. of the eggs hatched at the latter temperature and only 1 per cent. of the insects completed their development. The total development period occupied 8–9 months at 15°C. In wheat with a moisture content of 15 per cent., the egg, larval, prepupal and pupal stages occupied 2–6, 19·4, 2 and 8 days, respectively, at 29°C., and the adults remained in the grains for three days before emerging. In wheat with a moisture content of 11 per cent., the life-cycle lasted three days longer and mortality reached 20 per cent. at the same temperature ; mortality was even higher at temperatures above and below 29°C. Very few weevils completed their development when the moisture content was below 11 per cent. Mortality due to dryness or unfavourable temperatures was highest among first-instar larvae. In a heavy infestation, two weevils and sometimes three were able to complete their development in a single grain, though the larval stage was prolonged. Restricted infestations by *R. dominica* have occurred in one or two places since April 1941 [*cf.* **32** 63]. Eggs of this species hatched at temperatures between 18°C. [64·4°F.] and 38·6°C. [101·48°F.] ; mortality in the egg stage was 20 per cent. at 38·6 and 90 per cent. at 38·7°C. [101·66°F.].

An outbreak of *Loxostege affinitalis*, Led., occurred in South Australia for the first time on record in January and February 1941 ; much of the cultivated land is under stubble or lying fallow at this season, but the larvae caused some damage to garden crops and perennial plants in natural pastures. *Nezara viridula*, L., which has become well established during the past five years,

was present in 1942 in the Adelaide district and in parts of the irrigation area on the River Murray. *Microphanurus basalis*, Woll., an egg parasite of this Pentatomid, and *Comperiella bifasciata*, How., a parasite of the red scale [*Aonidiella aurantii*, Mask.] on *Citrus* were both introduced in December 1942. The cabbage butterfly, *Pieris rapae*, L., was found to be well established in various parts of the State [*cf.* **32** 28].

French (C.). **Records of native Insects attacking introduced Plants.**—*Vict. Nat.* **61** no. 3 pp. 58–60. Melbourne, 1944.

A list is given of some 40 species of Australian insects with the introduced plants that they have been observed to attack and the indigenous food-plants of some of them.

Massee (A. M.). *Pediculopsis graminum* **E. Reuter, 1900 : a Species of Tarsonemid new to Britain.**—*Ann. Mag. nat. Hist.* (11) **11** no. 75 pp. 190–194, 5 refs. London, 1944.

Pediculoides (*Pediculopsis*) *graminum*, Reut., was found infesting oats in two localities in Devon in the summer of 1941 ; gravid females and larvae were numerous in the stems of oat shoots received from one of them. A translation is given of the original description of both sexes of this mite.

Tooke (F. G. C.). **The Biological Control of the Eucalyptus Snout Beetle, *Gonipterus scutellatus*, Gyll.**—*Sci. Bull. Dep. Agric. For. S. Afr.* no. 235, 16 pp., 15 figs., 3 fldg. maps. Pretoria, 1942. [Recd. 1944.]

This is a summarised report of investigations on the control of *Gonipterus scutellatus*, Gylh., on *Eucalyptus* in South Africa, by the egg-parasite, *Anaphoidea nitens*, Gir., which was introduced from Australia in 1926 and was first found to be established in 1927 [*cf. R.A.E.*, A **20** 269 ; **22** 224]. During 1928–31, 620,000 individuals of this Mymarid were bred in the laboratory and liberated in the four provinces, and it is now believed to be present in every plantation in the infested areas. Control has been excellent in all areas except the dry high veldt ; there it was very disappointing until 1938 [*cf.* **23** 508], but is now more satisfactory, though still very erratic.

The reasons for the varying results obtained are discussed in some detail. It is shown that in the winter-rainfall area (the south and south-west of Cape Province), the climate is similar to that of the south-eastern States of Australia, to which *G. scutellatus* is mainly restricted, and that the life-history of the weevil is identical in the two regions. There are two generations and a partial third each year, eggs of the first and second being present in July–November and December–February, respectively, and those of the third from early April through the winter. The parasite can thus find host eggs throughout the year, so that its numbers are never seriously reduced and the percentage parasitism remains high. In the summer-rainfall areas along the coastal belt from Port Elizabeth to Durban, the third generation of the weevil is much smaller ; eggs are rare from April until the end of winter, and the overwintered females do not begin to oviposit until September, after a period of 4–6 weeks in which there is a definite cessation of oviposition. The Mymarid must, however, be well able to bridge this period, since the percentage parasitism remains high throughout the year. In the high veldt, at altitudes of 4,000–6,000 ft., there is no third generation and oviposition by the overwintered weevils does not begin until October. The complete absence of eggs from May to October causes a very great reduction in the numbers of the parasite. The way in which it survives is unknown, but no parasitism is found until December or January, when it is about 0·5–5 per cent. It then increases rapidly and is more than 90

per cent. by the end of the summer, resulting in almost complete destruction of the second generation of the beetle, but in many areas this control is too late to save the trees from considerable injury, as most damage is done in the early summer when they are putting on new growth.

Since 1933, there has been an improvement in the condition of plantations in the high veldt. It is considered that the balance between foliage output and beetle population before that year was such that almost complete defoliation took place, owing to the fact that conditions were unfavourable to both parasite development and tree growth. Since then, the balance has been altered by the steady progress of the parasite, the effect first becoming noticeable where conditions are most favourable for tree growth. It is emphasised that any adverse factor, such as drought or increasing competition among the trees as they become bigger, may be sufficient to cause an apparent retrogression.

JOUBERT (C. J.). **Mealy Bugs on Vines.**—*Bull. Dep. Agric. For. S. Afr.* no. 243, 20 pp., 19 figs., 23 refs. Pretoria, 1943.

Pseudococcus maritimus, Ehrh., has been recognised as a pest of grape-vines in South Africa since 1895 and *P. citri*, Risso, since 1930. One case of infestation by *P. adonidum*, L., was observed in the autumn of 1938, but it is unlikely to become a serious pest on vines. Characters by which the first two may be distinguished are given, with notes on their distribution on vines in South Africa and other parts of the world. Pears, pumpkins, potatoes and carrots are sometimes heavily infested by *P. maritimus* and figs, *Citrus* and guava by *P. citri*; their food-plants in South Africa probably exceed 80 and 100 species, respectively.

The eggs of *P. maritimus* are deposited in sheltered positions in masses of less than 100 to more than 500 and covered with an ovisac. They hatch in about a week in summer, but in winter the incubation period may last two months or more and the nymphs may remain under the ovisac for ten days. The life-cycle lasts about 60 days under favourable conditions in summer and sometimes up to five months later in the season. When reared on potato sprouts under laboratory conditions, this mealybug had three generations and a partial fourth in a year. The life-history of *P. citri* is similar, but the female deposits considerably more eggs, the life-cycle may be completed in 30 days under favourable conditions, and there may be eight generations a year. Natural enemies comprise Hymenopterous parasites [*cf.* *R.A.E.*, A **32** 89], Coccinellids [**27** 323; **32** 90], Neuroptera and Diptera, but their activities are hampered by the ants that feed on the honeydew secreted by the mealybugs [*cf.* **27** 323; **32** 90].

The first and often the sole requirement for the successful control of the mealybugs is ant control [*cf.* **26** 202], and it is cheaper than fumigation, even if supplementary spraying is necessary. Fumigation with hydrocyanic acid gas [*cf.* **31** 138] gives immediate results, however, and is sometimes justified by the value of the crop. Details are given of treatment with liquid HCN at the rate of 18 cc. per 100 cu. ft. or with gas generated at the same rate from sodium cyanide by the pot method or from calcium cyanide in the form of Calcid briquettes or Cyanogas powder. Isolated infestations may be effectively treated with a spray of 3 fl. oz. nicotine sulphate and 3 oz. soap in 4 gals. water, applied thoroughly to all parts of the plants after all loose bark and superfluous wood have been removed and burnt, at the end of winter, just before the mealybugs begin to move, and again as soon as they appear in spring. If an infestation is found on the foliage and fruit bunches in summer, the whole plant should be sprayed thoroughly, pruned severely, all fruit and loose bark being removed and destroyed, and sprayed again. The treatment should be repeated if the mealybugs reappear. Other control measures comprise rubbing off females

that settle round the bases of the young canes in spring and checking weeds by regular and timely cultivation during summer. All plant and packing material should be examined for infestation and treated or destroyed if necessary.

HEM SINGH PRUTHI & TASKHIR AHMAD. **Fatal Temperatures for the Pink Bollworm (*Platyedra gossypiella* Saund.) of Cotton.**—*Indian J. agric. Sci.* **11** pt. 6 pp. 906–924, 11 refs. Delhi, 1941. [Recd. 1944.]

A detailed account is given of experiments in the United Provinces, some of the main results of which have already been noticed [*R.A.E.*, A **30** 317; **31** 357], on the degree of exposure to heat necessary to destroy diapausing larvae of *Platyedra gossypiella*, Saund., in cotton seed. They were carried out with a view to standardising the treatment under Indian conditions, as previous work, which is reviewed, had indicated that its effectiveness depends on many factors, among which are the variety of seed, the temperature to which it is exposed before and after treatment and the prevailing moisture content of the atmosphere in the country concerned.

The experiments included the exposure of seed in a single layer in a thermostatically controlled hot oven or on flooring of various types in the sun, and tests to determine the temperature to which larvae removed from the seed will succumb. Naked larvae and larvae enclosed in the large, soft, hairy seeds of an American variety of cotton, or in the more compact seeds of a native variety, were exposed to various high temperatures and the results are shown in detail. At 70°C. [158°F.] the time required to effect 100 per cent. mortality was 1–3, 3–5 and about 7 minutes, respectively, and it was found that, at all temperatures, the larvae were killed more easily in the American seed than in the native seed. The effect of moisture in reducing the resistance to heat of larvae enclosed in seeds [**31** 357] was confirmed by experiments in which 100 per cent. mortality of naked larvae was obtained in 24 hours at 45°C. [113°F.] or in 2½ hours at 50°C. [122°F.] when the saturation deficiency of the air was 3–14 mm., but not when it was 32 mm. The resistance of the larvae under dry conditions is probably due to their effect in producing the diapause [*cf.* **28** 532, etc.] as a quiescent stage of an insect is known to be more resistant to heat than an active stage.

The effects of various exposures to heat on the viability of cotton seed [*cf.* **31** 357] are shown in a table. It is concluded that, though there is a margin of safety between exposures fatal to larvae and those injurious to the seed, the retention of very high temperatures in the seed, particularly if it is stored in sacks immediately after treatment, might be dangerous. It was found that for effective treatment in a hot-air chamber, the seeds must be spread in a thin layer and stirred constantly and the hot air above them kept in constant motion.

The results of the experiments in exposing infested seeds to the heat of the sun are also given in detail. The shade and soil temperatures at which larvae in double seeds exposed in a single layer all died in 10 minutes [*cf.* **30** 317] are here given as 42·2–42·7°C. [107·96–108·86°F.] and 60–65·7°C. [140–150·26°F.].

SINGH (R. N.). **The Life-history, Biology and Ecology of the Apple Root Borer, *Lophosternus hügelii* Redtenbacher in Kumaun.**—*Indian J. agric Sci.* **11** pt. 6 pp. 925–940, 1 pl., 7 refs. Delhi, 1941. [Recd. 1944.]

Apple trees in the northern hill districts of the United Provinces are attacked and often killed by the larvae of *Dorysthenes* (*Lophosternus*) *huegeli*, Redt., which bore into or girdle the roots and occasionally the stem below the surface of the ground. Pear, peach, cherry and plum have only occasionally been attacked, though larvae in confinement will feed on the roots of all fruit trees grown in these districts. They also feed on the dead stumps and roots of apples and of various forest trees and shrubs.

All stages of this Prionid are described, and the results are given of studies of its bionomics, some of which have already been noticed [*R.A.E.*, A **30** 559, 585]. Adult emergence normally begins when the monsoon breaks [*cf.* **30** 585] and continues for about a month. The adults, which do not feed, remain in holes under grass during the day and fly by night, pairing soon after emergence. The males live for only a few days, and the females for about 16, during which period they lay about 300 eggs, usually singly, at a depth of about 8 mm. in the soil but not necessarily near a food-plant. The egg, larval, pre-pupal and pupal stages occupy about 1, 42, 3 and 2–3 months, respectively. Many larvae die owing to their inability to find food ; experiments showed that they move at the rate of about 4 inches a month and only by chance in the direction of a root.

ANNAND (P. N.). **The War and the Future of Entomology.**—*J. econ. Ent.* **37** no. 1 pp. 1–9. Menasha, Wis., 1944.

In this discussion, the author points out that, as a result of war conditions, entomological research in the United States has been concentrated on immediate problems, to the detriment of fundamental investigations, but emphasises that the prompt solution of many war problems has been due to the availability of a background of research information. The war has drawn attention to serious gaps in the accumulated knowledge of insects, but the technical advances made, the development of new insecticides and appliances, the increased study of insects affecting seed production and of the importance of honey-bees as pollinating agents, due to the shortage of imported seeds, and the establishment of surveys of the abundance of serious insect pests and the appearance of new ones, designed to facilitate intelligent distribution of the available insecticide supplies, will have a marked influence on the progress of entomological research and practice after the war. The great dislocation of normal trade has emphasised the importance of foreign quarantines, and the unusual demands incident to the movement of war supplies that of domestic quarantines. The interest in food protection and the national urgency for food production have increased the public knowledge and appreciation of entomology, given an opportunity to test the effectiveness and practicability of preventive entomology on a large scale under several conditions, and shown the importance of the work of extension entomologists in enlisting the co-operation of farmers in applying control principles developed by research. The increased urgency of the situation and scarcity of man-power has stimulated co-operation in attacking entomological problems, and increased international co-operation was recommended by the United Nations Conference on Food and Agriculture in May 1943. There is, however, a great reduction in the numbers of entomologists now being trained, and this loss will probably be felt more severely in years after the war than at present.

The author considers that although any detailed plans for post-war entomology must inevitably be upset by facts not now known, the magnitude of the problem and the suddenness with which it will be encountered make advance consideration by those who have the responsibility for administering entomological activities desirable, and he discusses various points in some detail.

JONES (E. W.). **Biological Studies of two Potato Flea Beetles in eastern Washington.**—*J. econ. Ent.* **37** no. 1 pp. 9–12, 2 figs., 4 refs. Menasha, Wis., 1944.

Although *Epitrix subcrinita*, Lec., has sometimes damaged the foliage of potato on irrigated land in eastern Washington, injury of commercial importance to the tubers, which has occurred there since 1936, has been attributed to the

larvae of the flea-beetle that has been recorded as *E. cucumeris*, Harr. [*cf. R.A.E.*, A **20** 684 ; **31** 93] but is now known to be another species [*E. tuberis*, Gentner]. An account is given of investigations on the biology of the two species, their abundance in the area and their relation to tuber injury, carried out in 1940 [*cf.* **31** 93]. In the laboratory at 70°F., with larvae fed on slices of potato, the average durations of the egg, larval, prepupal and pupal stages and of development from egg to adult were 8, 15·3, 6·1, 8·2 and 40·7 days for *E. tuberis* and 8, 16·6, 12·7, 9 and 49·2 for *E. subcrinita*. Females of *E. tuberis* deposited 106–139 eggs each during 17–30 days, the majority within 10 days at 80°F. and within 20 days at 70°, and females of *E. subcrinita* laid 4–14 over periods of 25–30 days, the majority within 10 days at both temperatures. In July, 100 adults of *E. subcrinita* were released in each of two field cages enclosing potato plants and 50 of *E. tuberis* in each of three ; the tubers in the cages containing *E. subcrinita* showed no flea-beetle injury, whereas nine tubers in those containing *E. tuberis* showed 211 tunnels and 28 surface tracks made by the larvae. Each species required about the same time for development as it did in the laboratory. Catches in a trap with nets rotating at heights of 2 and 6 ft., operated between 9 a.m. and 5 p.m. from 10th July to 26th September, indicated that there was little flight before noon and none when the wind velocity exceeded 7 miles per hour ; temperature and intensity of light were less important. *E. subcrinita* was taken on all days when weather conditions were favourable, but *E. tuberis* was not caught until 28th July. About 88 per cent. of the beetles in the trap were *E. subcrinita*, and more than 75 per cent. of both species were caught at a height of 2 ft., indicating that flights are probably from plant to plant rather than for long distances. Adults of the first generation emerged during the last week in July and the first in August and those of the second generation in September [*cf.* **31** 355]. Observations in other localities confirmed that *E. subcrinita* was by far the more abundant and that it did not injure potato tubers. Tubers were severely injured in September when the counts of *E. tuberis* in July had averaged 16–18 per 25 sweeps with a net, but there was no commercial damage in fields showing less than 5 per 25 sweeps, the number of tunnels being less than 10 per tuber, and none in fields in which the catch of *E. subcrinita* averaged 15–45 per 25 sweeps and *E. tuberis* was scarce.

Gilmore (J. U.) & Levin (C.). **Control of the Tobacco Flea Beetle by Cultural Practices in Plant Beds.**—*J. econ. Ent.* **37** no. 1 pp. 13–15, 1 fig., 2 refs. Menasha, Wis., 1944.

Owing to the damage caused by blue mould (*Peronospora tabacina*) in tobacco plant beds in North Carolina since 1931, the area allotted to them has been increased from 50 to 100–200 sq. yards per acre of tobacco field in order to ensure an adequate supply of seedlings. In some years, however, severe damage does not develop, and this results in a large surplus of unused plants. As the beds are usually on land not used for crops and are abandoned after they have supplied the necessary plants, they are an important source of *Epitrix parvula*, F., which migrates to the fields of recently transplanted tobacco [*cf. R.A.E.*, A **29** 201]. Cultural methods of disposing of the surplus plants were therefore investigated, and their effect in preventing the development of larvae in the soil was measured in open and pole-type beds in 1940 and in closed beds in 1941 [*cf.* **32** 127] by trapping the adults in cages as they emerged. Pulling the plants and scraping the soil to a depth of about an inch with a hoe, which is practicable in small areas such as plant beds, gave 70–88 per cent. control, ploughing and harrowing gave 61–64 per cent., and ploughing alone, which destroyed the fewest plants, gave 43–53 per cent. The measures were most effective in closed beds.

Miner (F. D.). **Selection of Soil Entrance and Oviposition Sites by June Beetles.**—*J. econ. Ent.* **37** no. 1 pp. 16–18. Menasha, Wis., 1944.

The following is substantially the author's summary of this account of work in Arkansas during 1943. Factors influencing the choice of sites for soil entrance and oviposition by species of *Lachnosterna* (*Phyllophaga*) were studied under cage conditions after it had been noted that beetles in the field frequently shelter by day in débris near food-plants. In one experiment there was no apparent choice between plant species by *L.* (*P.*) *fervida*, F., as measured by total oviposition. There was some indication that thicker stands of plants were preferred. Little difference in oviposition was noted in a wide selection of soils under uniform moisture conditions. Other experiments indicated that soil covered with partly-rotted wheat straw was more attractive to *L. fervida* and *L.* (*P.*) *crassissima*, Blanch., as a place of entrance than soil with growing wheat seedlings. The presence of wheat roots in the soil apparently stimulated oviposition by *L. crassissima*.

Fife (L. C.). **Reduced Dosages of Calcium Arsenate and Cryolite for Control of the Boll Weevil and their Effect on the Cotton Aphid.**—*J. econ. Ent.* **37** no. 1 pp. 19–21. Menasha, Wis., 1944.

The results are given of experiments in Texas in 1942 to determine the effect of reducing dosages of calcium arsenate and cryolite on the control of *Anthonomus grandis*, Boh., and on *Aphis gossypii*, Glov. Calcium arsenate (2·2–4·3 per cent. water-soluble arsenic pentoxide, 40 per cent. total arsenic pentoxide), cryolite (86 per cent. sodium fluoaluminate) and mixtures of these with conditioned dusting sulphur (325-mesh containing 94·4 per cent. sulphur and 5·4 per cent. non-volatile matter) were applied in a series of tests between 3rd July and 12th August, and calcium arsenate with or without sulphur and a mixture of basic copper arsenate and sulphur were used in a second series between 20th July and 27th August. All the dusts were applied early in the morning, when the cotton was usually damp or wet with dew and the air calm, and eight effective applications were made in each series. All the control plots in the first series and all plots in the second were dusted twice with Paris green and lime (14 : 86) in late July and early August to control *Alabama argillacea*, Hb. The tests were made in fields planted about a month later than usual, and a general migration of the weevil from early to late fields began on 15th July, after which infestation rapidly increased in all plots, remaining high throughout the remainder of the season.

The yield of the control plots in the first series was 954 lb. seed cotton per acre, and an increase of at least 307 lb. was required for significance. The respective increases were 716, 614, 550 and 448 lb. for calcium arsenate at the rate of 7·4 lb. per acre and mixtures of calcium arsenate and sulphur (1 : 2, 1 : 3 and 1 : 5) at 11·6, 13·6 and 12·5 lb. per acre, and 256, 202 and 398 lb. for cryolite at 6 lb. per acre and mixtures of cryolite and sulphur (1 : 2 and 1 : 3) at 11·5 and 11·9 lb. per acre. In the second series, in which the control yield and significant difference were 307 and 216 lb., calcium arsenate alone at 6·8 and 8·1 lb. per acre and calcium arsenate with sulphur (1 : 1) at 7·7 lb. per acre gave increases of 440, 398 and 263 lb. per acre, and basic copper arsenate and sulphur (1 : 1) at 9 lb. per acre gave an increase of 198 lb. The sulphur probably controlled other insects, such as the Capsid, *Creontiades signatus*, Dist., which was rather injurious in several plots in the first series in June and July. Only plots treated with calcium arsenate alone and with sulphur (1 : 2) showed significant reductions in infestation by *Anthonomus*. Aphids were never sufficiently numerous to cause appreciable damage, but calcium arsenate and the mixtures

of calcium arsenate and sulphur, with the exception of the 1 : 5 mixture, caused significant increases in Aphid populations in the first series. Cryolite alone and with sulphur did not cause significant increases.

Schwitzgebel (R. B.) & Walkden (H. H.). **Summer Infestation of Farm-stored Grain by migrating Insects.**—*J. econ. Ent.* **37** no. 1 pp. 21–24. Menasha, Wis., 1944.

The flight of insect pests of stored grain in the vicinity of bins of wheat, their migration into the bins by flight or by crawling and their seasonal abundance were investigated at a site in Kansas containing approximately 190 bins varying in capacity from 1,000 to 5,000 bushels and exposed to insect migration from surrounding farm land and an elevator a few hundred yards to the east. In July 1942, flight screens coated with an adhesive and erected on the four sides bounding the bin site trapped *Laemophloeus minutus*, Ol., *Typhaea stercorea*, L., *Ahasverus advena*, Waltl, *Calandra* (*Sitophilus*) *oryzae*, L., and *Rhizopertha dominica*, F., of which the first two were the most abundant. Most insects were caught on the sides of the screens away from the bins and on those to the north of the site. A revolving trap with two nets, one three feet from the ground and the other six feet, run intermittently from April to October 1942, caught single individuals of *Tribolium castaneum*, Hbst., *C. oryzae* and *R. dominica* in May and June, small numbers of *L. minutus*, *A. advena* and *Typhaea stercorea* during the first week in July and large numbers of these three species, small numbers of *R. dominica* and insignificant numbers of four other species from the beginning of the second week in July until September. The heaviest flight occurred between 6 p.m. and dusk ; few insects were in flight during the hot summer days, but insects were caught during the cooler hours of the day in more moderate weather. The average catch per hour was 2 insects from 7 a.m. to 5 p.m. and 39 from 5 p.m. to 7 a.m. Approximately 55 per cent. of the insects were caught in the upper net.

Ventilator traps to catch insects entering a 1,000-bushel bin containing wheat with a moisture content of 13 per cent. took about 1,333 pests of stored grain, comprising *A. advena*, *L. minutus*, *T. stercorea*, *R. dominica* and *Plodia interpunctella*, Hb., in descending order of abundance, in September 1941. Other insects caught included 5,000 Psocids and numerous parasites of grain-infesting insects, including *Aplastomorpha calandrae*, How., *Cephalonomia tarsalis*, Ashm., *C. waterstoni*, Gah., *Chaetospila elegans*, Westw., *Eurytoma neomexicana*, Gir., *Bracon* (*Microbracon*) *hebetor*, Say, and a species of *Plastanoxus*. Two ventilator traps operated continuously from 2nd April until 1st November 1942 to catch insects entering bins containing wheat with a moisture content of 11 per cent. caught more than 35,000 Psocids throughout the season from 6th April, grain mites from 10th April and *L. minutus*, *Oryzaephilus surinamensis*, L., *Plodia interpunctella*, *R. dominica*, *Ahasverus advena*, *T. stercorea*, *Calandra oryzae* and *Tribolium castaneum* from 17th April, 13th, 14th and 15th May, 15th and 25th June and the first and second weeks in July, respectively, catches being highest during July–September. The totals comprised 1,166 examples of *L. minutus*, 301 of *A. advena*, 143 of *R. dominica*, 128 of *Typhaea stercorea*, 9 of *C. oryzae* and 1–3 of the other insects.

A. advena and *T. stercorea*, which are attracted to grain with a high moisture content and feed chiefly on moulds growing on decaying grain, are of little importance to grain in good condition, but *R. dominica* and *C. oryzae* are serious pests, and *L. minutus* and *Tribolium confusum* are often associated with heating grain and responsible for caking on the surface.

York (G. T.). **Food Studies of *Geocoris* spp., Predators of the Beet Leafhopper.**—*J. econ. Ent.* **37** no. 1 pp. 25–29, 2 figs., 7 refs. Menasha, Wis., 1944.

The following is based on the author's summary. The experiments were designed to determine the function of plants and animals as food for *Geocoris punctipes*, Say, and *G. pallens*, Stål, as fundamental information needed in a projected attempt to use these predators in the biological control of the beet leafhopper, *Eutettix tenellus*, Baker. Cage experiments in the laboratory at Modesto, California, showed that these two Lygaeids could not live on insects alone or on plants alone, but required a combination of the two. Apparently the plants served only as a source of water. When sugar-beet leaves were available, *Geocoris* lived equally well on beet leafhoppers alive, dead and preserved by refrigeration, or dead and air dried. The mortality was increased if the leafhoppers had been treated with ether to remove the fat, but even then some food was available. The presence of dead insects did not reduce feeding on live leafhoppers. During the summer the adults consumed about one adult leafhopper every two days. They also fed on the nymphs and on the eggs of *E. tenellus*, which are laid in plant tissue, the average daily consumption by *G. pallens* during the summer being 2·5 eggs per day for males and 4 per day for females.

Steiner (L. F.), Arnold (C. H.) & Summerland (S. A.). **The Development of large Differences in the Ability of local Codling Moths to enter sprayed Apples.**—*J. econ. Ent.* **37** no. 1 pp. 29–33, 5 refs. Menasha, Wis., 1944.

The following is almost entirely based on the authors' summary. Laboratory and orchard tests with more than 14,000 newly hatched larvae of *Cydia* (*Carpocapsa*) *pomonella*, L., from each of two similarly situated orchards 37 miles apart in the extreme south-west of Indiana, which were sprayed alike until 1936, showed that differences in the ability of the populations to enter sprayed fruit have apparently developed within the last five years. Larvae from one, which has been sprayed heavily with lead arsenate since 1936, entered fruit sprayed with lead arsenate, nicotine bentonite, cryolite or xanthone in significantly greater numbers than those from the other, which has not been sprayed since 1936. No differences between the strains could be found in the ability of the larvae to enter unsprayed fruit or fruit sprayed with phenothiazine, in the numbers of eggs laid by the moths, or in the resistance of the eggs to xanthone, micronised nicotine bentonite, mineral oil or mineral oil and nicotine, and observations indicated that larvae of the strain least susceptible to lead arsenate spent less time in attempting entrance and crawled shorter distances over the fruit than the other, suggesting that the difference in its so-called resistance was due to behaviour rather than to general vigour [*cf. R.A.E.*, A **32** 350]. Its resistance was considerably greater to lead arsenate than to nicotine, so that nicotine was more effective against it than lead arsenate in laboratory tests, but less so against the less resistant strain.

The results suggest that increases in the proportion of resistant strains in a population of *C. pomonella* can be retarded, if not prevented, by using more supplementary measures and insecticides that kill more of the adults and eggs than lead arsenate. They also show the need for a survey of the variation in apparent resistance that may exist among different orchard populations in localities in which comparative tests of insecticides are being made.

Fahey (J. E.). **Changes in Ratio of Lead to Arsenious Oxide in Lead Arsenate Residues on Apples.**—*J. econ. Ent.* **37** no. 1 pp. 33–36, 8 refs. Menasha, Wis., 1944.

Further investigations on the ratio of lead to arsenious oxide in lead-arsenate spray residues [*cf. R.A.E.*, A **27** 539; **29** 412] were carried out in Indiana in

1941 with apples taken from plots that received different spray schedules after the second and subsequent cover sprays, at the end of the weathering period of each spray and at harvest. Part of each plot was left unsprayed after the fourth cover spray so that the effect of prolonged weathering might be studied, and these trees were sampled 17, 31, 45 and 89 days after the application of the final cover spray. Analysis of the lead arsenate employed showed the initial ratio of lead to arsenious oxide to be 21 : 10. Apples from a plot that received seven cover sprays of lead arsenate and lime showed a significant increase in the ratio during the periods after the third, sixth and seventh sprays (3rd–10th June, 16th–28th July and 30th July–10th September) ; samples from plots treated with six cover sprays of lead arsenate and mineral oil after one of lead arsenate alone, seven cover sprays of lead arsenate, Bordeaux mixture and a wetting agent or seven of lead arsenate and Bordeaux mixture, with mineral oil added in the second, third and fourth, showed significant increases during the first of these periods only, and those from a plot receiving lead arsenate alone in all seven sprays during the first and third. The amount of rainfall was 1·66 inches during each of the first two of these periods, and 5·94 inches during the third ; all other intervals had less rainfall. Samples from a plot treated with four cover sprays of lead arsenate and Bordeaux mixture showed no significant changes during any of the periods of weathering. After only four cover sprays, all the residues showed a gradual increase in the ratio of lead to arsenious oxide during the remainder of the growing season, but none of the changes were significant until after 45 days (2·4 inches rain), and those for lead arsenate alone, with mineral oil and with Bordeaux mixture and a wetting agent were not significant until 89 days after the first analysis.

It is thus shown that the change in ratio of lead to arsenious oxide became significant in residues from lead arsenate alone only when they were allowed to weather for extended periods ; the addition of mineral oil, Bordeaux mixture or both reduced the rate of decomposition, and the addition of lime accelerated it.

Borden (A. D.). **Xanthone in the Control of Codling Moth and Mites on Apples and Pears in California.**—*J. econ. Ent.* **37** no. 1 pp. 36–42, 2 refs. Menasha, Wis., 1944.

Lead arsenate, used throughout the season for the control of the codling moth [*Cydia pomonella*, L.] on apple or pear in California, usually results in high lead and arsenic residues, frequently causes foliage injury, particularly during the foggy months of June, July and August, and fails to protect pear from *Paratetranychus pilosus*, C. & F., and *Tetranychus bimaculatus*, Harvey. Attempts were therefore made to find a substitute for use in cover sprays.

In the experiments described, all the quantities are given per 100 U.S. gals. spray and all trees for which rates of infestation by *C. pomonella* are given received two calyx sprays of lead arsenate, except on one plot in 1942. In 1939, pear trees that received five cover sprays of 2 lb. xanthone, 1 lb. whale-oil soap and 1 lb. hydrated lime or one of 4 lb. lead arsenate and four of 2 lb. xanthone suffered no injury from mites [*cf.* also *R.A.E.*, A **31** 500], whereas those that received five lead-arsenate cover sprays were almost completely defoliated soon after harvest. The numbers of codling-moth larvae per 100 fruits were 2·6, 1·7 and 0·5, respectively ; residues of lead and arsenic on unwashed fruit from the first two treatments were below the legal tolerances at harvest.

In 1940, apple trees receiving three cover sprays of 2 or 3 lb. xanthone or 3 lb. lead arsenate, all with 1 U.S. qt. kerosene and a proprietary spreader, showed 1·3–8·4, 0·5–3·8 and 0·5–2·9 larvae per 100 fruits ; the average xanthone deposits after the second application were 52 mg. per sq. in. for the first treatment and 73 mg. for the second, and the leaves on these trees were larger and darker than those on trees sprayed with lead arsenate, which showed considerable arsenical injury and fairly heavy leaf drop. In another apple orchard, treatment with two sprays containing 2 lb. xanthone, 1½ U.S. pints

kerosene and a spreader, or 3 lb. cryolite or 5 lb. nicotine bentonite, each with 1 U.S. qt. light oil resulted in 0·7, 1·7 and 0·4 larvae per 100 picked fruits and 2, 1 and 3 per 100 windfalls; the xanthone treatment resulted in fruit of high uniform colouring, but the others caused considerable mottling. Pear trees sprayed with 4 lb. xanthone, 1½ U.S. pints kerosene and a spreader on 12th and 29th April, 6th June and 8th July showed no spray injury to fruit or foliage at harvest (30th July) and kept dark green foliage until late in the season, and others on which 3 lb. xanthone was substituted for 3 lb. lead arsenate in the spray applied on 12th July showed an average of 1·8 immature and 2·8 mature mites per leaf, as compared with 5·2 and 29·3 for lead arsenate, later in the day on 12th July, and 0·5 immature and 4·1 mature mites per leaf with very little foliage injury, as compared with 73·7 and 21·2 and severe leaf injury over the whole tree, on 5th August.

In 1942, the first cover spray applied to apple trees, on 18th May, was immediately followed by a sudden rise in temperature from 90 to 103°F. for three days. Trees on one plot receiving four sprays of 2 lb. xanthone, 1 U.S. qt. kerosene and a spreader, phenothiazine, cryolite or nicotine bentonite and those receiving no cover sprays had 4, 2, 7, 7 and 20 larvae per 100 picked apples and 9, 8, 12, 20 and 53 per 100 windfalls. Light drop of the oldest leaves and slight russeting of the fruit, which persisted until harvest, occurred after the first cover spray on all trees sprayed with xanthone. At the end of the season, however, the foliage of trees treated with phenothiazine or xanthone was healthier than that of other trees, and fruit sprayed with xanthone had a better colour and was more free from the woolly aphis [*Eriosoma lanigerum*, Hsm.] and from excrement of the leafhopper, *Typhlocyba* (*Empoa*) *rosae*, L.; when taken from cold-storage the following April, this fruit was in better condition than that from the other trees. Trees of the same variety on an adjacent plot that received only one calyx spray followed by four sprays of 3 or 1½ lb. xanthone and 1–2 U.S. qts. kerosene or ¾ lb. xanthone and 1 U.S. qt. kerosene, all with a spreader, showed 2, 6 and 10 larvae per 100 picked apples and 9, 20 and 38 per 100 windfalls, as compared with 43 and 78 for trees that received no cover sprays. Analysis of ten leaves and ten apples showed comparatively high deposits after each application, but considerable weathering between applications in spite of which control was satisfactory. On this plot, the foliage of trees treated with 2 lb. xanthone and 2 U.S. qts. light oil in the first cover spray dropped or was severely scorched, and the fruit was badly russeted; spraying of these trees was therefore discontinued. Pear trees treated with three sprays of 1½ or 3 lb. xanthone and 2 U.S. qts. kerosene or with 3 lb. lead arsenate, all with a spreader, had 0·3, 0·04 and 0·04 larvae per 100 picked fruits and 0·9, 0·3 and and 1 per 100 windfalls, and others that received two applications of ¾ lb. xanthone and 1 U.S. qt. kerosene or 3 lb. lead arsenate, each with a spreader, or 2 lb. micronised phenothiazine had 0·3, 0·2 and 0·1 larvae per 100 picked fruits and 2·1, 2·2 and 0·9 per 100 windfalls. No spray injury occurred, but mite injury was severe in the phenothiazine plot and one of the lead-arsenate plots.

In field tests made in 1943, xanthone gave definitely better control of *C. pomonella* than lead arsenate and also controlled *T. rosae* and *Eriosoma* on apple and mites on pear. The method of mixing xanthone in sprays is described, and suitable spreaders and adhesives for use with it are recommended. It is much less toxic to man than arsenicals, and its spray residues are not considered injurious; they were readily removed by all types of commercial washer tested.

Dickinson (B. C.) & Witman (E. D.). **The relative Effectiveness of two Types of Arsenate of Lead used to control the Codling Moth.**—*J. econ. Ent.* **37** no. 1 pp. 43–46, 2 figs., 2 refs. Menasha, Wis., 1944.

Electron micrographs of the lead arsenate normally used as an insecticide (so-called amorphous lead arsenate) and a form manufactured by a new process

whereby the physical properties of the component particles are altered ("crystalline" lead arsenate) showed both to be crystalline in structure. In the case of the "crystalline" form there appeared to be increased aggregation of the individual particles to form a larger platelet. There was no consistent difference in the relative effectiveness of the two types in laboratory tests against larvae of the codling moth [*Cydia pomonella*, L.]. Both exhibited considerable repellency to the larvae, and it is considered that this factor should be given more consideration in future insecticide investigations.

SNAPP (O. I.) & CULLINAN (F. P.). **The Effect on Peach Trees of Ethylene Dichloride used for Control of the Peachtree Borer.**—*J. econ. Ent.* **37** no. 1 pp. 47–51, 4 refs. Menasha, Wis., 1944.

In view of a number of reports of injury to peach trees resulting from treatment with ethylene-dichloride emulsion for the control of *Aegeria* (*Sanninoidea*) *exitiosa*, Say, in 1940 [*cf. R.A.E.*, A **32** 174], experiments were carried out in Maryland in 1940–42 to obtain more complete information on the possibility of injury from its use and the conditions under which injury is most likely to occur. The following is substantially the authors' summary. No injury resulted from the treatment of peach trees in several different soils under a wide range of conditions when ethylene dichloride was used at the recommended quantity and strength (½ U.S. pint of 20 per cent. emulsion for mature trees and ½ U.S. pint 15 per cent. emulsion for three-year-old trees [*cf.* **27** 256]) and when it was applied in the currently approved manner, namely, on the soil round the base of the tree in such a way that it does not touch the trunk directly. The moisture content of the soil had no effect on injury when the emulsion was applied early in October, nor did injury increase when the application was made to moderately dry soil in the middle of November. Damage did occur, however, when the emulsion was tested at strengths or quantities higher than recommended and when it was applied in water-logged, heavy soil late in autumn when temperatures were low [*cf.* **30** 529], and injury was more severe in the heavy soils. Applying the emulsion directly to the trunks of the trees increased the injury [*cf.* **32** 76].

GUNTHER (F. A.) & LA DUE (J. P.). **Determination of Oil Deposit on Citrus Leaves by the Steam-Distillation Method.**—*J. econ. Ent.* **37** no. 1 pp. 52–56, 1 fig., 2 refs. Menasha, Wis., 1944.

The following is the authors' summary. Directions are given for the adaptation of a steam-distillation method of determining oil deposit to the quantitative determination of deposits of two of the lighter grades and four of the standard grades of spray oils, on lemon leaves. The major difference between this adaptation and the kerosene adaptation previously described [*R.A.E.*, A **31** 99] lies in the use of dilute phosphoric acid, instead of an aqueous solution of sulphuric acid, nitric acid and aluminium sulphate, as the decomposition medium. Data are presented to justify the alterations adopted for this expanded utility, and to indicate the high degree of reproducibility and efficiency of this new adaptation.

The results from 42 representative calibration runs (seven runs for each of the six oils studied) indicate an average standard deviation of 1·63 per cent. for these oils.

YUST (H. R.), NELSON (H. D.) & BUSBEY (R. L.). **Factors influencing Protective Stupefaction of the California Red Scale with HCN.**—*J. econ. Ent.* **37** no. 1 pp. 57–61, 4 refs. Menasha, Wis., 1944.

An account is given of further investigations on the protective stupefaction of second-moult and mature female scales of a resistant strain of *Aonidiella*

aurantii, Mask., by exposure to low concentrations of hydrocyanic acid gas before the regular fumigation [*cf.* *R.A.E.*, A **31** 100, etc.], with particular reference to the interrelations of temperature, prefumigation dosage and the interval between prefumigation and final fumigation. Scales on lemon fruits were reared in the laboratory or obtained in the field and preconditioned and postconditioned for four hours at the treatment temperature. All concentrations of fumigant are given per litre. The percentages of mature females dead after prefumigation for 10 minutes with 0·01, 0·025, 0·05 and 0·1 mg. immediately followed by fumigation with a constant concentration of 0·8 mg. for 40 minutes at 68° F. were 91·8, 65·9, 64 and 66·3; the percentages after final fumigation only, prefumigation with 0·1 mg. only, and no treatment were 96, 6·3 and 2·3. The percentages after prefumigation with 0·025 mg. for 2, 4, 7 and 10 minutes immediately followed by the same final fumigation were 95, 94·2, 72·6 and 65·9, indicating that no stupefaction occurred in 2 or 4 minutes. The mortality percentages in mature females reared at 72°F. and fumigated for four hours at 68°F. with 0·009, 0·025, 0·041 and 0·14 mg. were approximately 6·9, 23·3, 24·8 and 41·2, which suggests that some concentrations may be slightly toxic and still produce protective stupefaction. When second-moult scales and mature females were fumigated at 50, 59, 68 or 77°F. with dosages decreasing during exposure from about 2·75 to 0·1 and 2·3 to 0·9 mg., respectively, with or without prefumigation for 45 minutes at dosages falling from 0·14 to 0·03 and 0·04 to 0·01 mg., mortalities of both were lower after prefumigation. An increase in kill as the temperature was lowered was shown in scales that had not been prefumigated but not in those that had.

In a series of laboratory fumigations under conditions simulating those in the field, both stages were fumigated at temperatures of 50, 59, 68 and 77°F. and prefumigated with different concentrations either immediately or two hours before the final fumigation. In the second moult, the higher prefumigation concentration (0·17–0·04 mg.) immediately before the final exposure produced more protective stupefaction at all temperatures than the lower concentration (0·04–0·01), though the latter produced some at all temperatures except possibly 77°F. With mature females, more stupefaction resulted from the lower prefumigation concentration at 50°F., but from the higher concentration at 77°. It is evident that more HCN is required to stupefy both stages as the temperature rises, and that more is needed to stupefy the earlier stage. With the low prefumigation concentration, the mortality of the earlier stage at 50°F. was the higher because of differential stupefaction of the two stages. Much of the protection was usually lost when two hours elapsed between prefumigation and the final treatment. In general, mature females remained stupefied longer than scales in the second moult. The period over which protective stupefaction continued was influenced by prefumigation concentration and temperature. In the second moult, protective stupefaction was lost in two hours with the higher concentration, but not always with the lower. The stupefaction of mature females after two hours decreased as the temperature increased, and at 77°F. the kill of those stupefied two hours earlier was higher than that of those not stupefied. Prefumigation alone was usually not toxic to scales in the second moult. In further tests with a very low prefumigation concentration (0·02–0·008 mg.) at 50° and relatively high ones (0·2–0·05 and 0·28–0·07) at 59°, scales in the second moult were not stupefied after exposure for 45 minutes to the low concentration, but mature females were. At 59°, the higher concentration produced more stupefaction in the second moult, but the lower more in the mature females, when applied immediately before the final fumigation. There was stupefaction after a two-hour interval in both stages, and this was higher then than immediately after prefumigation in the case of mature females.

Finney (G. L.), Flanders (S. E.) & Smith (H. S.). **The Potato Tuber Moth as a Host for Mass Production of** *Macrocentrus ancylivorus*.—*J. econ. Ent.* **37** no. 1 pp. 61–64, 4 figs. Menasha, Wis., 1944.

The authors describe the equipment used for the propagation of *Gnorimoschema operculella*, Zell., on potato tubers and the mass production of the parasite, *Macrocentrus ancylivorus*, Rohw., on this laboratory host for the control of *Cydia* (*Grapholitha*) *molesta*, Busck, in California [*cf. R.A.E.*, A **32** 211]. The use of the potato tuber as a propagation medium permits production throughout the year with a minimum of labour and space; if adequately infested, it is completely utilised within 20 days, allowing a quick turnover of production material, conserving space and forestalling deterioration due to rot and mites. Since it is essential to have a continuous supply of tuber moths that is large enough to maintain the stock as well as to provide host material, separate moth and parasite units are kept in operation. The procedures for the production of moth breeding stock and of parasites are described, the sequence of events in the process of *Macrocentrus* production is shown in a table and plans for the liberation of the parasites in orchards are given. The parasites are to be colonised while still in the host cocoons, emergence of all tuber moths from each cocoon card before it is placed in the orchard being effected by employing infesting material of uniform age and by withholding the parasites from the units as long as possible, consistent with the obtaining of maximum parasitism.

Hutzel (J. M.) & Howard (N. F.). **Sources of Variations in the Effectiveness of Derris Dusts.**—*J. econ. Ent.* **37** no. 1 pp. 65–69, 6 refs. Menasha, Wis., 1944.

The following is substantially the authors' summary. Derris-dust mixtures prepared from different samples of roots and containing equivalent concentrations of rotenone were subject to marked variations in effectiveness when applied in the laboratory against larvae of *Epilachna varivestis*, Muls. Tests were therefore carried out in 1941 to determine the source of these variations. It was found that the effectiveness of derris-dust mixtures depends on both the chemical and the physical properties of the ground root, varying inversely as the particle size, directly as the number of toxicant particles per unit of mixed dust and directly as the rotenone content, when any two of these variables are held constant. When of similar particle size, dusts impregnated or coated with extracts of the ground root vary in effectiveness directly as the number of toxicant (coated) particles per unit of mixed dust.

The physical properties were interpreted as influencing the rate and quantity of toxicant absorption by determining the surface area of the toxicant coming into contact with the absorbing surfaces of the insect. It appears that preparation of derris-dust mixtures should include some compensation for differences in the number of toxicant particles per unit of mixed dust as influenced by particle size and proportion of ground root, instead of being prepared entirely according to the active chemical constituents.

Swingle (M. C.), Gahan (J. B.) & Mayer (E. L.). **Laboratory Tests of synthetic organic Compounds as Insecticides.**—*J. econ. Ent.* **37** no. 1 pp. 70–74, 3 refs. Menasha, Wis., 1944.

The following is the authors' summary. The results of laboratory insecticide tests made to determine the possible effectiveness of 82 synthetic organic compounds are briefly discussed. The compounds were tested against from 5

to 9 of 16 different species of insects, and 11 of the compounds were found to be moderately toxic to the insects used. The most effective compound was 2-chlor-6-nitrotoluene, which is a volatile material and was effective as a fumigant. None of the compounds appeared useful as practical insecticides.

GLASS (E. H.). **Value and Use of volatile Nitriles for Household Fumigation.**—*J. econ. Ent.* **37** no. 1 pp. 74–78, 4 refs. Menasha, Wis., 1944.

Previous work on the toxicity of nitriles is reviewed, and an account is given of tests of trichloracetonitrile as a household fumigant alone and mixed with an equal quantity of acrylonitrile. Both are colourless liquids, volatile at room temperature, very toxic to insects but not highly dangerous to warm-blooded animals. The former is a lacrymator at concentrations that are not immediately dangerous and is not inflammable. Acrylonitrile is inflammable between the limits of 3 and 17 per cent. by volume in air and has no warning properties. Comparative tests of various conditions were made in a constant temperature fumigation chamber with a capacity of 740 cu. ft. furnished as a bed-room. For each test, five glazed, unperforated pill boxes containing 10 last-instar nymphs or adults of the bed-bug [*Cimex lectularius*, L.], five containing 10 adults of the confused flour beetle [*Tribolium confusum*, Duv.] and five containing 4–5 larvae of the black carpet beetle [*Attagenus piceus*, Ol.] were distributed about the chamber. For application, the desired quantity of liquid was poured into a jar containing absorbent pellets, which were later spread upon gauze suspended about a foot from the ceiling. A dosage of 1 lb. per 1,000 cu. ft. was used in all tests. Both trichloracetonitrile and the mixture were more effective at 75–85 than 55–60° F. Temperature did not affect the period of airing necessary after fumigation, but moist conditions (relative humidity almost 100 per cent.) prolonged it by several hours. Moisture did not influence effectiveness. The length of exposure did not influence the period necessary for airing, but exposure for 12 hours was consistently more effective than exposure for 6. With 12 hours' exposure, both trichloracetonitrile and the mixture gave 100 per cent. mortality of all insects at the higher temperatures and of all except the larvae of *Attagenus* at the lower ones. An increase in the moisture content of furnishings within a day or two after the fumigation caused eye irritation after all effect on the eyes had ceased under dry conditions.

The results of seven practical fumigations, in which the pellets were spread on a gauze tray on a six-foot tripod, indicated that a dosage of 2 lb. trichloracetonitrile per 1,000 cu. ft. for 6 hours or 1·5 lb. for 12 hours should be adequate in a tightly closed building. Slightly higher concentrations or longer exposures may be necessary when the mixture is used, particularly if the larvae of clothes moths or carpet beetles are present. Aeration was so rapid that it was possible to fumigate a house during the day, ventilate it for a few hours and allow the occupants to return the same night. Operators should wear gas masks while charging and distributing the pellets and when entering a house under fumigation. In houses being opened for ventilation, exposure to the vapour of trichloracetonitrile for 10–15 minutes resulted in a burning sensation in the scrotum, but this can be avoided by leaving the house after about 5 minutes and returning to complete the task a little later. Contact of both liquids with the skin caused a transitory tingling sensation without subsequent injury. The methods of testing for the presence of gas after airing are described.

MCGREGOR (E. A.). **Toxicity of Anabasine to the Citrus Thrips.**—*J. econ. Ent.* **37** no. 1 pp. 78–80, 5 refs. Menasha, Wis., 1944.

After preliminary cage tests with anabasine and anabasine sulphate against *Scirtothrips citri*, Moult., on lemon leaves, the results of which have already been noticed [*cf.* *R.A.E.*, A **32** 210], cover glasses coated with residues of

anabasine and sugar were put in cages containing thrips. Microscopic examination after 24 hours revealed no trace of the characteristic feeding pits, indicating that anabasine probably acts as a contact insecticide or fumigant. The addition of sugar probably retards the loss of toxic material. Adults placed on tissue paper sealed in immediate contact with a dry residue of a solution of anabasine (1 : 1,000) and sugar on the upper surface of lemon leaves (0·3 ml. solution per leaf) immediately exhibited the typical reactions to anabasine, and 99 per cent. were dead after 24 hours. When this was repeated with anabasine-sulphate solution (1 : 600) and sugar, 92 per cent. were dead after 24 hours ; thrips put on tissue paper sealed to untreated leaves showed none of the symptoms. Thrips that were allowed to feed in cells on leaf surfaces half an inch below the ceiling, which was coated with 0·3 ml. anabasine (1 : 1,000) and sugar solution per 30 sq. cm. and shielded from contact with the thrips by means of tissue paper sealed closely to the dried residue, were all active after four days. In a similar experiment with anabasine sulphate (1 : 600) and sugar, 85 per cent. were alive after 24 hours.

It is concluded that there is a definite fumigating action from the dry residues of anabasine and sugar, in addition to any purely contact effect, but that its range of effectiveness is less than half an inch. Both the alkaloid and the sulphate appeared to affect the larvae and adult males more rapidly than the adult females.

English (L. L.) & Turnipseed (G. F.). **The Fumigation of Camellia and Azalea Cuttings with Methyl Bromide.**—*J. econ. Ent.* **37** no. 1 pp. 81–84, 1 ref. Menasha, Wis., 1944.

Under greenhouse conditions in Alabama, azalea cuttings often become seriously infested with *Paratetranychus ilicis*, McG., and *Heliothrips haemorrhoidalis*, Bch., and *Camellia* cuttings with *P. ilicis*, *Lepidosaphes camelliae*, Hoke, and *Fiorinia theae*, Green ; dense populations of these pests cause defoliation of the cuttings and consequent failure to root, and lighter infestations remain after transplanting, causing unhealthy and undesirable plants. Investigations were therefore undertaken to determine whether the concentrations of methyl bromide necessary for their control [*cf. R.A.E.*, A **32** 202] would injure the cuttings.

The following is substantially the authors' summary. Tests with cuttings from 58 varieties of azalea and 45 of *Camellia* showed that most of them could be safely fumigated at the dosages necessary. Cuttings from two varieties of azalea apparently cannot be satisfactorily fumigated with methyl bromide. In a series of approximately equivalent dosages and exposures at various temperatures, the long exposure required with a dosage of $\frac{1}{2}$ lb. per 1,000 cu. ft. was detrimental to the survival of cuttings. Rooted cuttings placed in flats of moist sand were also successfully fumigated when removed from the greenhouse for transplanting. Since several thousand cuttings can be fumigated in a relatively small chamber, this practice affords a cheap method of producing clean plants. A schedule of 2 lb. methyl bromide per 1,000 cu. ft. with exposures of $1\frac{1}{4}$ hours at 90°F. or $2\frac{1}{4}$ hours at 80°F. meets the practical requirements.

Knight (P.). **Insects associated with the Palay Rubber Vine in Haiti.**—*J. econ. Ent.* **37** no. 1 pp. 100–102. Menasha, Wis., 1944.

Since *Cryptostegia grandiflora* is being planted on a large scale in the Republic of Haiti in connection with the emergency rubber programme of the United States government, and there is evidence that some insects attacking it may reach outbreak proportions as the acreage increases, the author gives the results of observations made in a semi-desert area from 10th February to 14th April 1943. The chief pest during this period was *Aphis gossypii*, Glov.,

which was most injurious to the young plants and the vigorous new growth of older ones. Seedlings were attacked as soon as they developed their first leaves, and damage continued through all stages of growth. Populations increased considerably soon after the beginning of the wet season, on 3rd April. The Aphid was abundant on *Cryptostegia* growing wild, but the percentage of infested shoots was much lower than in the plantations ; *Cryptostegia* was always more heavily infested than cotton, possibly because the Aphids on it were not parasitised, whereas *Lysiphlebus testaceipes*, Cress., parasitised *A. gossypii* on cotton as well as *A. maidis*, Fitch, on maize and grasses and an undetermined Aphid on *Asclepias*. The apparent freedom from parasitism may be due to certain properties of the latex of *Cryptostegia*, though it may occur on this plant elsewhere or at other seasons. Predators of *A. gossypii* included Coccinellids, of which *Cycloneda sanguinea* var. *limbifera*, Csy., and *Scymnus* sp. were extremely abundant at all times, *Leucopis simplex*, Lw., which was particularly abundant in seedling beds, and *Baccha clavata*, F., which was numerous on plants of all ages ; *Pachyneuron allograptae*, Ashm., was found to have parasitised 74 per cent. of the *Baccha* puparia found on the plants and all those of a less common Syrphid.

Saissetia coffeae, Wlk. (*hemisphaerica*, Targ.) was less abundant than *A. gossypii*, but appears to be capable of far more serious injury to the plantations, as it was increasing in numbers and spreading very rapidly. Wild *Cryptostegia* that has been growing vigorously for many years in the neighbourhood was slightly infested. Parasitism was negligible, only a single individual of *Coccophagus cubaenis*, Comp., being reared. Several species of ants, of which the most common were *Solenopsis geminata*, F., and *Dorymyrmex pyramicus* var. *niger*, Perg., were constantly associated with the scale. *S. geminata* may seriously inconvenience the harvesters by its biting and may reduce the production of seed by injuring the flowers. The number of ant-infested blossoms ranged from 3 per cent. after heavy rain to 34 per cent. after 2–3 days of dry weather ; activity in the blossoms usually ceased before noon. In experimental plots, the ants were excluded from the vines by trying a small wad of cotton round the base of each plant.

Chewing insects were extremely rare on *Cryptostegia* in the dry season, but in early April, large numbers of weevils, including *Prepodes* (*Exophthalmus*) *quadrivittatus*, Ol., and species of *Lachnopus* and *Artipus*, began to cause serious injury to the leaves, buds and tender shoots. Also at the onset of the wet season, adults of *Oncopeltus aulicus*, F., migrated to *Cryptostegia* from species of the related genus *Asclepias*, on which this Lygaeid had been present throughout the dry season. The Cicadid, *Proarna hilaris*, Germ., was occasionally observed on the plant, but was not seen to oviposit.

Lack of seed production by *Cryptostegia* was a serious problem when these observations were made. Pollination is not accomplished unless insects remove the " translator " from between the stamens and the pistil. The only insects observed to do this (except ants, which injure the flowers in the process) were the Hesperiids, *Atalopedes mesogramma*, Latr., and *Lerodea* sp. Larger Lepidoptera and the Scoliids, *Campsomeris tolteca*, Sauss., and *C. trifasciata*, F., attempted to enter the flowers but were unable to do so owing to their size.

FRENCH (G. T.). *Anthocomus bipunctatus* (Harrer), **a new Household Insect.**—*J. econ. Ent.* **37** no. 1 p. 103. Menasha, Wis., 1944.

A Malachiid, adults of which were taken in large numbers in houses in Richmond, Virginia, in March, April and May 1943 and on rose and apple flowers in April was identified as *Anthocomus bipunctatus*, Harrer, by H. S. Barber, who considers that the larvae probably feed on household insects,

such as silverfish. This European beetle has only once before been found in the United States, two examples having been collected in a house in New Jersey in 1940. The adult is very briefly described.

GOODEN (E. L.). **Particle Size of commercial Calcium Arsenates by Air-permeation Tests.**—*J. econ. Ent.* **37** no. 1 pp. 104–105, 1 fig., 8 refs. Menasha, Wis., 1944.

The results are given of determinations of the particle size of a number of samples of commercial calcium arsenates, believed to be collectively representative of insecticidal calcium arsenate on the American market, by means of a self-calculating air-permeation apparatus [*cf. R.A.E.*, A **29** 397]. The surface mean diameters, as determined by this method, lay almost exclusively between 0·5 and 1·5 microns. Comparison with data on the percentage of water-soluble arsenic by the Geneva method [*cf.* **24** 256] showed a distinct trend towards association of large particle size with high soluble arsenic, though the low correlation coefficient indicates that neither property can be predicted accurately from the other without the introduction of an equally important additional factor or group of factors.

The accuracy of different methods of estimating particle size is discussed.

FLANDERS (S. E.). **Observations on *Prospaltella perniciosi* and its Mass Production.**—*J. econ. Ent.* **37** no. 1 p. 105, 5 refs. Menasha, Wis., 1944.

Prospaltella perniciosi, Tower, was introduced into California from the Atlantic seaboard of the United States in March 1943 for the control of the San José scale [*Quadraspidiotus perniciosus*, Comst.], and about 200,000 females were produced for liberation by the end of the year. It was recovered during July from infested peach trees at Cucamonga. High rates of parasitism of *Q. pernicious* by this Aphelinid were observed in Massachusetts in 1912 by H. T. Fernald [but *cf. R.A.E.*, A **7** 503 ; **10** 78], and in Brazil in 1934 by H. Compere.

The rearing technique was similar to that used for the red scale [*Aonidiella aurantii*, Mask.] [*cf.* **31** 487], but citron melons (*Citrullus vulgaris*) were used as the food-plant. At about 80°F., the scale matured about 37 days after hatching on fruits 6–8 ins. in diameter. All post-embryonic stages were attacked, and the parasite matured in a minimum of about 19 days at the same temperature, but its development was sometimes prolonged if the host was in its first stage when parasitised. In the course of mass production on *Citrullus*, the male sex disappeared from the cultures, and *P. perniciosi* is therefore probably uniparental in reproduction, though mating occurs readily. The condition of the scale in which it developed may determine whether a female is thelyotokous or amphitokous.

COX (J. A.). **Sprays of 2, 4-Dinitro-6-cyclohexylphenol for Control of the White Apple Leafhopper.**—*J. econ. Ent.* **37** no. 1 p. 106, 1 ref. Menasha, Wis., 1944.

In the course of experiments with sprays on apple in Virginia, it was observed that dinitro compounds caused a decided reduction in infestation by *Typhlocyba pomaria*, McAtee, and tests with these sprays for the control of the Jassid were therefore carried out in 1943. The materials used were D-41, which contains 40 per cent. of 2, 4-dinitro-6-cyclohexylphenol, and DN-111, which contains 20 per cent. of a dicyclohexylamine salt of this phenol, and the sprays were applied very thoroughly before the Jassids reached the adult stage. They contained 5 oz. D-41 with 2 oz. blood albumin or 20 oz. DN-111 per 100 U.S. gals. water. Two applications at an interval of eight days gave 89·7 and 87·2 per

cent. reduction in population, as compared with 94 per cent. for single application of 1 pint nicotine sulphate, and ¼ pint Grasselli spreader-sticker per 100 gals., and caused no injury to the foliage. One application of the dinitro compounds did not give satisfactory control.

Richardson (H. H.), Schechter (M. S.) & Haller (H. L.). **The Toxicity of Cyclopropyl Alkyl Ethers and Trichloromethanesulfonyl Chloride to the Confused Flour Beetle.**—*J. econ. Ent.* **37** no. 1 pp. 111–112, 5 refs. Menasha, Wis., 1944.

Cyclopropyl methyl, ethyl and propyl ethers were tested as fumigants against *Tribolium confusum*, Duv., at 6–8 concentrations ; the period of exposure was 5 hours at 25°C. [77°F.], and mortality records were taken after 10 and 20 days. The approximate concentrations required to kill 50 and (in brackets) 95 per cent. of the insects, as determined from curves drawn on logarithmic probability paper, were 82 (105), 40 (50) and 72 (90) mg. per litre, respectively, as compared with 56 (100) mg. for carbon bisulphide. Cyclopropyl ethyl ether was thus the most toxic, and this compound appeared to have some delayed killing action similar to that of ethylene dichloride [*cf. R.A.E.*, A **31** 242].

Trichlormethanesulphonyl chloride was compared with paradichlorbenzene as a fumigant for *T. confusum* in an air-flow apparatus [*cf.* **29** 132]. In a series of nine paired tests with exposures of 1–2½ hours to saturation concentrations (8·3 and 8·02 mg. per litre, respectively, at 25°C., when the air-flow was 6 litres per hour) the average kills after 20 days were 24·3 and 47·1 per cent., respectively. Both chemicals had some latent effect that increased the mortality slightly between the 4th and 20th days after fumigation. Tests at various concentrations indicated that approximately 5·7 and 8·3 mg. trichlormethanesulphonyl chloride per litre were needed to give 50 and 90 per cent. kill, respectively, in five-hour exposures at 25°C. ; with only half this exposure, paradichlorbenzene killed nearly 90 per cent. at 8·02 mg. per litre.

Bissell (T. L.). **Armyworms in Georgia.**—*J. econ. Ent.* **37** no. 1 pp. 112–113, 1 fig., 3 refs. Menasha, Wis., 1944.

Cirphis unipuncta, Haw., is very seldom injurious to crops in Georgia, though it is continuously present there. The hibernating larvae have been collected in each winter from 1936 to 1940, in ground cover, such as dead grass and leaves under pecan trees, some in December and April, but most in January–March. The adults have been commonly taken in light-traps since 1937 ; the earliest collection was on 3rd March, the latest on 5th December, and the largest ones always in autumn. In 1943, local outbreaks occurred at several places in the central part of the State. A field of brown top millet [*Panicum*] was defoliated in late July, and large numbers of larvae were observed crawling on the ground in various directions ; at one point they were moving up and down a ditch bank 30 ins. high and practically vertical. Millet was the only crop damaged in this locality, cotton being uninfested even in fields in which crab-grass [*Digitaria sanguinalis*] was destroyed. Excellent control was obtained with a bait of 25 lb. wheat bran, 1 lb. Paris green or sodium fluosilicate and 2 U.S. gals. water, applied at the rate of 25 lb. per acre. At another place, large numbers of larvae stripped the lower leaves of maturing maize in August and were found on millet, Johnson grass [*Sorghum halepense*] and crab-grass, but injury was slight.

Activity of *Laphygma frugiperda*, S. & A., has been observed every year since 1934 ; the larvae usually become noticeable towards the end of July, though they were taken on maize in May in 1939 and 1940. Activity increases in August and September and continues into October. The moths have been taken at light from 8th May to 6th November. *L. frugiperda* is a serious pest of

late maize in Georgia ; the records of infestation during 1934–43 comprised 21 on maize, 5 on cowpeas, 3 on pepper [*Capsicum*], 3 on grass, 2 on dahlia and 1 each on collards, cotton, gladiolus, millet and ground-nuts [*Arachis hypogaea*]. Characters by which the larvae of the two species may be distinguished are given.

English (L. L.). **A Slide Rule for estimating Schedules for fumigating with Methyl Bromide.**—*J. econ. Ent.* **37** no. 1 pp. 114–115, 2 figs., 6 refs. Menasha, Wis., 1944.

The following is the author's summary. The construction of a slide rule for use in fumigating plants with methyl bromide is described. The rule provides for the estimation of schedules covering a dosage range of 0·5 to 4 pounds of methyl bromide per 1,000 cubic feet, an exposure range of 1 to 10 hours, and a temperature range of 60 to 100°F. A scale of load-factors permits a wide selection of fumigation schedules. The use and adaptation of the slide rule are discussed.

Fleming (W. E.) & Chisholm (R. D.). **Anethole and Pimenta Leaf Oil as Attractants for the Japanese Beetle.**—*J. econ. Ent.* **37** no. 1 p. 116. Menasha, Wis., 1944.

A mixture of geraniol and eugenol has long been recommended as a bait for use in traps for *Popillia japonica*, Newm., in the United States, but attempts to find substitutes for either or both have been in progress for several years [*cf. R.A.E.*, A **31** 488]. Anethol, which is a natural constituent of anise oil, star anise oil and fennel oil and is prepared synthetically from pine oil, and pimento leaf oil, obtained in the West Indies by distillation of the leaves of *Pimenta officinalis*, were tested during the summers of 1941–42. In preliminary tests in which each of the four baits was used in five traps, arranged 25 ft. apart so that it was in competition with several groups of other baits, there was no significant difference in effectiveness between mixtures of 9 parts geraniol or 9 parts anethol with either 1 part eugenol or 1 part pimento leaf oil, and more extensive tests gave similar results. It is therefore concluded that anethol can be substituted for geraniol and pimento leaf oil for eugenol without modifying the value of the bait significantly. It was observed that the rate of evaporation of the anethol baits was more than three times that of the geraniol baits, and further investigations on the possibility of reducing this rate of evaporation without changing the effectiveness significantly are required.

Fulton (R. A.), Busbey (R. L.) & Yust (H. R.). **Toxicity of Nitroparaffins and Chlorinated Nitroparaffins to California Red Scale and their Effect on Lemon Fruits.**—*J. econ. Ent.* **37** no. 1 p. 117, 1 ref. Menasha, Wis., 1944.

In laboratory tests in California in which each compound was tested at a concentration of 20 mg. per litre at 59, 77 and 90°F., and at 40 mg. per litre at 59° against *Aonidiella aurantii*, Mask., on lemon fruits, insects were killed in all tests with 1-chlor-1-nitroethane, 1,1-dichlor-1-nitroethane [*cf. R.A.E.*, A **30** 192] 1-chlor-1-nitropropane and 1,1-dichlor-1-nitropropane, but the fruits were injured by all the compounds at 59 and 77°F., and by all but the last at 90°. At equal concentrations, the monochlor nitroparaffins were the more injurious. Nitromethane, nitroethane, 1-nitropropane and 2-nitropropane gave no significant mortality and caused no fruit injury.

Carter (Walter). **The Use of D-D Mixture against** *Anomala* **and** *Adoretus* **infesting Nursery Stock.**—*J. econ. Ent.* **37** no. 1 pp. 117–118, 1 ref. Menasha, Wis., 1944.

The results are given of small-scale tests carried out in Hawaii with a mixture of [equal parts of] 1,3-dichlorpropylene and 1,2-dichlorpropane, known as

D-D mixture, as a fumigant against larvae of *Anomala orientalis*, Waterh., and *Adoretus sinicus*, Burm., in soil round the roots of nursery stock [*cf.* *R.A.E.*, A **31** 360]. Actively growing plants of seven genera were used. The cans in which they were growing and similar cans containing larvae were plunged into 0·5, 1 and 2 per cent. dilutions of an emulsion of 60 cc. crude D-D mixture, 40 cc. diesel oil, 5 gm. bentonite and 100 cc. water, and allowed to drain; serious injury to the plants and complete mortality of the insects resulted. Watering each can with 500 cc. of a saturated solution of the mixture in water (approximately 2 : 1,000) also resulted in serious injury to the plants and complete mortality of the insects. This solution diluted with an equal amount of water caused no injury to the plants and complete mortality of the insects, and a dilution of 1 in 4 caused practically complete mortality in 48 hours, but still more diluted solutions failed to kill all *Anomala* larvae.

Knowlton (G. F.). **Pentatomidae eaten by Utah Birds.**—*J. econ. Ent.* **37** no. 1 pp. 118–119. Menasha, Wis., 1944.

The stomachs of 225 out of 2,373 birds belonging to 33 species, examined in Utah, contained the recognisable remains of 384 adult and 3 nymphal Pentatomids; 197 Pentatomid eggs were also found. Lists are given of the birds, showing for each species the numbers examined, the numbers containing Pentatomids and the numbers of the latter in them, and the numbers of each species of Pentatomid that could be identified.

Dicke (F. F.) & Barber (G. W.). **Husk Characters of Field Corn in Relation to Feeding by Birds on Earworms.**—*J. econ. Ent.* **37** no. 1 pp. 119–120. Menasha, Wis., 1944.

Observations in Florida in June 1940 on a variety of maize that has very tough tightly clinging husk leaves showed unusually large numbers of larvae of *Heliothis armigera*, Hb., crawling over the plants or feeding, partially exposed, in the silks, but relatively little damage, owing to the destruction of the larvae by birds. In the course of an experiment with six varieties of field maize carried out in Virginia in 1941, data were obtained on the relation of husk extension to the frequency with which the larvae were removed from the ears by birds. Examination of the ears 15 and 30 days after half the plants had developed silks revealed about 30 per cent. less larvae at the later date, largely owing to attack by birds, particularly *Agelaius phoeniceus*, which visited the field to obtain food for its young in July and appeared to prefer larvae in the fifth and sixth instars. In general, least earworm damage occurred in the ears with least husk extension, the percentage of larvae removed from infested ears decreasing as the husk extension increased. These observations indicate that birds may reduce the damage caused by earworms to a considerable extent in varieties of maize with short tight husks; they sometimes cause incidental damage by feeding on the kernels of ears from which they have removed larvae.

Driggers (B. F.). **Performance of Dichlorodiphenyl Trichloroethane (DDT) used against the Oriental Fruit Moth.**—*J. econ. Ent.* **37** no. 1 pp. 120–121. Menasha, Wis., 1944.

In experiments on the use of the dichlor-diphenyl-trichlorethane known as DDT [2, 2-bis (parachlorphenyl)-1,1,1-trichlorethane] to control the Japanese beetle [*Popillia japonica*, Newm.] on peach in central New Jersey in 1943, the first application of 1 lb. per 100 U.S. gals. water was made on 14th July, when larvae of the third generation of the Oriental fruit moth [*Cydia molesta*, Busck] were beginning to enter the fruit. All the fruits on two sprayed trees of each of two early- and two midseason-ripening varieties and on one

unsprayed tree to the north and one to the south of each sprayed tree were examined for injury by *C. molesta* between 6th and 21st August. In all cases there was very much less on sprayed than on unsprayed trees ; treatment was apparently effective for 3–4 weeks, as the reduction in injury was greater on the varieties harvested first. Damage on the unsprayed trees was less to the north than to the south of the sprayed trees, probably owing to spray drift, as the wind was blowing from the south when the sprays were applied. No spray injury to fruit or foliage was observed.

CARMAN (G. E.) & FLESCHNER (C. A.). **Laboratory Tests on the Oriental Fruit Moth with special Reference to DDT.**—*J. econ. Ent.* **37** no. 1 pp. 122–123. Menasha, Wis., 1944.

In preliminary laboratory tests of 2,2-bis (parachlorphenyl)-1,1,1-trichlorethane (DDT) against newly hatched larvae of *Cydia* (*Grapholitha*) *molesta*, Busck, carried out in California, six eggs were put on each of five apples, in individual cells 1 in. in diameter, for each test, by which method an average of 85–90 per cent. of the larvae entered untreated fruits. Pure recrystallised DDT and a dust containing 25 per cent. of this, each mixed with a little Triton NE [an aralkyl polyether alcohol] and enough Pyrax ABB [pyrophyllite] to bring the total of solids up to 4 lb. per 100 U.S. gals. spray, gave 39, 59 and 87 per cent. and 67, 76 and 92 per cent. protection, respectively, when used at the rate of 4, 8 and 16 oz. DDT per 100 U.S. gals. All higher dosages completely prevented entry. The use of the customary amounts of wetting agents generally decreased the effectiveness of the spray. In comparable tests, basic lead arsenate used at the rate of 3 lb. per 100 U.S. gals. gave only 9 per cent. protection. Additional experiments indicated that DDT is highly effective against the newly hatched larvae when dissolved in oil and other organic solvents or when prepared in dust mixtures, which completely prevented entry.

In tests to determine the effect on adults of *C. molesta*, newly emerged moths were caged in batches of ten with small potted plants that had been sprayed three days before with 1 lb. actual DDT, in the 25 per cent. mixture, per 100 U.S. gals. They were seldom observed to come in contact with the plants, but after 72 hours, 69 per cent. were dead or incapacitated ; 93 per cent. were alive in cages containing unsprayed plants. In other tests, newly emerged moths were put in cages sprayed with 1 lb. DDT per 100 U.S. gals. or dusted with 3 per cent. DDT. After 24 hours, 72 per cent. of the moths in the sprayed cages and 83 per cent. of those in the dusted cages were dead or incapacitated, and all were dead in 48 hours ; mortality in untreated cages was 3 per cent.

LINDGREN (D. L.) & BOYCE (A. M.). **Results with Dichloro-diphenyl-trichloroethane in Control of the California Red Scale.**—*J. econ. Ent.* **37** no. 1 pp. 123–124, 1 ref. Menasha, Wis., 1944.

In extensive laboratory tests with 2,2-bis (parachlorphenyl)-1,1,1-trichlorethane (DDT) for the control of *Aonidiella aurantii*, Mask., on *Citrus* fruits in California, a summary of which has already been noticed [*R.A.E.*, A **32** 264], emulsions containing 0·75 per cent. light-medium petroleum oil alone and with 2, 4 or 6 gm. DDT per 100 cc. oil killed 26·3, 34·8, 44·1 and 56·4 per cent. of the adult females and permitted 1,050, 60, 0 and 1 per fruit of the young that were born after treatment to settle and develop. Emulsions of xylene or benzene containing DDT had little effect on the adult females, but prevented the settling and development of young for at least 45 days, and suspensions of 2 lb. technical DDT per 100 U.S. gals. water prevented the development of more than 95 per cent. of the young. On fruits with deposits of DDT too light to kill the young scales born after treatment, development was retarded considerably. Tests in which powdered cubé root or derris extractives were incorporated in

light petroleum spray oils containing DDT to evaluate the combined effect of the high initial kill of adults given by the rotenone and rotenoids and the prolonged residual effect of DDT against the crawlers gave promising results ; the materials appeared to be compatible.

Oranges and lemons picked 50 days after treatment with light-medium petroleum spray oil or kerosene, alone or with DDT, about seven inches of rain having fallen during the interval, were infested with crawlers of *A. aurantii* in the laboratory ; 80–90 per cent. settled and developed on fruit treated with oil alone, but only 5–15 per cent. on those treated with the oils containing DDT. No plant injury was observed from any application of DDT.

ANNAND (P. N.) & others. **Tests conducted by the Bureau of Entomology and Plant Quarantine to appraise the Usefulness of DDT as an Insecticide.**— *J. econ. Ent.* **37** no. 1 pp. 125–159. Menasha, Wis., 1944.

The papers in this symposium are by the chief and members of the staff of the U.S. Bureau of Entomology and Plant Quarantine, and the following are abstracts of all but those dealing exclusively with Arthropods of medical or veterinary importance [*cf. R.A.E.*, B **32** 196–207].

ANNAND (P. N.). **Introductory Discussion of DDT,** pp. 125–126, 11 refs. One of the more promising proprietary materials tested during recent months as substitutes for insecticides that are no longer available is the synthetic organic compound 2,2-bis (parachlorphenyl)-1,1,1-trichlorethane, which, when chemically pure, is a crystalline solid, practically colourless, almost odourless and rather stable, insoluble in water, but soluble in most organic solvents and of low volatility. Formerly a technical grade manufactured in Switzerland was referred to as GNB, and one manufactured in the United States as GNB-A, but the designation DDT, derived from the alternative name dichlor-diphenyl-trichlorethane, has now been adopted [*cf. R.A.E.*, A **32** 264]. Preparations of the compound are marketed in Switzerland as Gesarol spray insecticide (containing 5 per cent. DDT in a diluent with a wetting agent and an adhesive) and Gesarol dust insecticide (3 per cent. DDT) for agricultural uses, and as Neocid (5 per cent. DDT) for use against lice on man. DDT acts as a nerve poison to insects [*cf.* **32** 321] and primarily as a nerve poison to higher animals ; it is distinctly toxic when ingested or dissolved in a solvent, such as oil, and absorbed through the skin. Preliminary data suggest, however, that it will probably be as safe to use against certain pests as some of the insecticides now employed. The loss of DDT by evaporation from spray deposits occurs too slowly to decrease its effectiveness appreciably.

MCGOVRAN (E. R.), RICHARDSON (H. H.) & PIQUETT (P. G.). **Toxicity of DDT to Bedbugs, Cockroaches, the Mexican Bean Beetle and Housefly Larvae,** pp. 139–140. This paper includes an account of tests on *Epilachna varivestis*, Muls. Bean leaves were treated with a spray of 8 lb. DDT per 100 U.S. gals. water with a wetting agent, allowed to dry and then infested with ten fourth-instar larvae. The mortality in six days was 45 per cent. as compared with 67 per cent. for one containing 1 lb. powdered derris root (4·8 per cent. rotenone) per 100 U.S. gals.

ST. GEORGE (R. A.). **Tests of DDT against Ants and Termites,** p. 140. Ants (*Formica* sp.) released in covered chambers that had been treated when the insides were moist with a solution of 5 per cent. technically pure DDT in acetone, and then allowed to dry, had considerable difficulty in walking within a few minutes of coming into contact with the residue and died in a few hours ; ants in an untreated container survived. A dust of 5 per cent. DDT in an inert diluent acted a little more slowly and a solution of 1 per cent. DDT in acetone more slowly still, but both were effective. Termites (*Reticulitermes flavipes*, Koll.) that were put in dusted chambers with a thin layer of moist earth on the

bottom succumbed within two days. In a field test in Maryland, in which the ground beneath each of three logs heavily infested with *R. flavipes* was treated on 3rd June, the termites disappeared below ground after treatment, but after a week, a few had become re-established in one of the logs. In further tests, pieces of paper towelling and Osnaburg fabric were immersed for two minutes in solutions of 1 or 5 per cent. DDT in acetone and laid on the ground beneath boards, and small white pine markers were soaked in the solutions for 18 hours and buried to half their length in the ground on 15th June. Examination on 30th June, 31st July and 30th October showed that untreated control pieces of towelling and fabric were attacked by the termites, though they had merely built tubes over the untreated wood. The towelling was the only one of the treated materials to be attacked, infestation being moderate in that treated with 1 per cent. DDT and very slight in that treated with 5 per cent., but tubes had been built over the treated fabric and wood.

Cotton (R. T.), Balzer (A. I.) & Young (H. D.). **The possible Utility of DDT for insect-proofing Paper Bags,** p. 140. DDT was the most effective of a large number of chemicals tested for impregnating paper to be made into bags for milled cereals and various dried foods, to prevent insects from penetrating them. In one series of tests, disks of soft towel paper and Kraft paper, impregnated with a solution of commercial DDT in acetone (1 : 10) and pasted over holes in the tops of boxes filled with a mixture of flour and rice polish and exposed for two months to attack by the cadelle [*Tenebroides mauritanicus*, L.] and the lesser grain borer [*Rhizopertha dominica*, F.] suffered no damage, whereas none of the other chemicals afforded complete protection. No tests have been made with this material on a commercial scale, and the possibility of contamination of food products in the bags requires investigation.

Swingle (M. C.) & Mayer (E. L.). **Laboratory Tests of DDT against various Insect Pests,** pp. 141–142. In recording the results of these tests, which were carried out in Florida against 20 species of insects, the terms DDT spray and double-strength spray are used for suspensions of 4 and 8 lb. per 100 U.S. gals. water of a spray powder containing 5 per cent. DDT and a wetting agent, and DDT dust for a dust of 3 per cent. DDT in an inert carrier, unless other concentrations are stated. The derris and pyrethrum used as standards for comparison contained 4·8 per cent. rotenone and 1·2 per cent. total pyrethrins, respectively. DDT dust gave complete kill of third-instar larvae of the Hesperiid, *Urbanus proteus*, L., on bean foliage within two days, with almost no feeding, the pyrethrum standard giving 96 per cent. kill ; DDT spray gave good control of the first three instars in a garden. DDT dust gave complete kill of adults of *Epicauta lemniscata*, F., on leaves of sea-kale beet (Swiss chard) within three days, and undiluted barium fluosilicate killed 96 per cent. DDT spray killed 0, 71 and 96 per cent. of the beetles in two, four and six days, respectively, and a suspension of 4 lb. cryolite per 100 U.S. gals. killed 25 and 75 per cent. in four and six days. DDT dust gave complete kill of fourth-instar larvae of *Plusia* (*Autographa*) *brassicae*, Ril., *Evergestis rimosalis*, Gn., and *Laphygma* (*Prodenia*) *eridania*, Cram., on collard leaves within two days, and the standard pyrethrum killed 96, 100 and 48 per cent., respectively, in the same time. DDT spray gave 90 and 100 per cent. mortality of the third instar of *E. rimosalis* in two and four days, as compared with 3 and 100 per cent. for a spray of 8 lb. derris per 100 U.S. gals. The double-strength spray gave 100 per cent. mortality of *L. eridania* within two days ; and the foliage was no less toxic to the larvae eight days after application of the spray. Weekly applications of DDT dust and the double-strength spray gave excellent control of the Capsid, *Halticus bracteatus*, Say, on small celery plants grown out of doors. DDT dust killed all stages of *Aphis spiraecola*, Patch, on young orange, though less quickly than a spray of nicotine sulphate (1 : 400), and gave complete mortality of first- and fourth-instar nymphs of *Anasa tristis*, Deg., on pumpkin in two days ; the standard pyrethrum gave the same results against the fourth-instar bugs. When mixed with peas or

wheat at the rate of 1 : 10,000 by weight, DDT dust gave complete mortality of adults of *Bruchus* (*Callosobruchus*) *maculatus*, F., in the peas and of adults of *Tribolium castaneum*, Hbst., in the wheat in two days, and 50 and 82 per cent. mortality of adults of *Calandra* (*Sitophilus*) *oryzae*, L., in the wheat in three and five days, respectively. When mixed with sand (1 : 10,000), DDT dust caused no mortality of adults of a species of *Reticulitermes* in two days, but prevented their entrance into the sand ; in five days, 97 per cent. were dead from exposure.

The spray powder, applied undiluted as a dust, gave complete mortality of large nymphs of *Peregrinus maidis*, Ashm., on a maize leaf within 24 hours and of fourth-instar larvae of *Pieris rapae*, L., on collard leaves within two days ; the same results were given by the pyrethrum standard in talc (1 : 10) and the derris standard, respectively. Dusts containing concentrations of DDT ranging from 1 to 100 per cent. and undiluted standard pyrethrum all killed about 90 per cent. of adults of *Murgantia histrionica*, Hahn, in two days. Dusts containing as little as 1 per cent. DDT killed 90–100 per cent. of fourth-instar larvae of *Plusia* oo, Stoll (*Autographa rogationis*, Gn.) in two days, and 0·6 per cent. dust killed 100 per cent. in three days. Diluted derris dust (0·96 per cent. rotenone) killed 89 per cent. in three days. DDT spray killed 62 per cent. on collards in six days, and the double strength spray killed 33, 85 and 96 per cent. in two, four and six days, respectively. Dusts containing various concentrations of DDT down to 0·6 per cent. killed 90, 100 and 100 per cent., respectively, of fourth-instar larvae of *Diaphania hyalinata*, L., and *D. nitidalis*, Stoll, on pumpkin foliage in two days ; diluted derris dsut (0·96 per cent. rotenone) killed 36 and 24 per cent. DDT spray and double-strength spray gave 100 per cent. mortality of *D. nitidalis* in four and two days, respectively, and both killed about 55 and 100 per cent. of *D. hyalinata* in two and four days. A spray containing 4 lb. derris per 100 U.S. gals. killed 100 per cent. of *D. nitidalis* in four days, but one containing 8 lb. killed only 77 per cent. of *D. hyalinata* in six. Another DDT spray (1 lb. DDT concentrate per 100 U.S. gals. water) gave complete mortality of all stages of *Leptinotarsa decemlineata*, Say, on potato plants in a garden. Two applications of the double-strength DDT spray or 1 per cent. DDT concentrate caused no injury to young bean plants, pumpkins, sea-kale beet or collards ; the former was also not injurious to pea plants and the latter to potatoes.

Ivy (E. E.). **Tests with DDT on the more important Cotton Insects,** p. 142, 2 refs. In cage tests in Texas in 1943, a dust of 2 per cent. DDT in pyrophyllite, used at the rate of 32 lb. per acre, caused an average mortality of 96 per cent. of third-instar larvae of *Heliothis armigera*, Hb., on cotton, as compared with 86, 77 and 62 per cent. for mixtures of sulphur with equal quantities of basic copper arsenate, cryolite (92·1 per cent. sodium fluoaluminate) and calcium arsenate, all applied at 16 lb. per acre. In other tests, the DDT dust gave 97, 82 and 63 per cent. mortality at 32, 16 and 8 lb. per acre, respectively. DDT acts on *H. armigera* both as a stomach and a contact poison, but the latter effect is believed to be the more important. Exposure for 30 seconds to dust clouds of this material resulted in 40, 90 and 100 per cent. mortality of fifth, fourth and third instars. Larvae in the third instar were killed in ten minutes and those in fourth and fifth instars in 100 minutes when put on blotting paper that had been dusted at the rate of 32 lb. per acre. Larvae fed on a dusted leaf sandwich consumed a lethal dose after exposure for 2–4 days. A water suspension of the dust of DDT and pyrophyllite killed the larvae when placed on the dorsum with a pipette ; the median lethal dose of DDT for 240 larvae in the fifth instar was 0·299 mg. per gm. body weight. The same dust was comparatively ineffective against *Alabama argillacea*, Hb. (35·5 per cent. kill) and *Anthonomus grandis*, Boh. (18·5 per cent.) when applied at the rate of 32 lb. per acre, and had little effect on *Aphis gossypii*, Glov. (15·4 per cent. mortality) in laboratory tests in which nicotine dusts (2 per cent.) gave 81 per cent. mortality.

Hills (O. A.). **DDT and other Insecticides for the Say Stinkbug and the Tarnished Plant Bug,** pp. 142–143. In cage tests in Arizona, a dust of DDT (10 per cent.) killed 89-95 per cent. of adults of *Chlorochroa sayi*, Stål, on branches of *Atriplex elegans*, but required 5 6 days to do so, though the bugs showed the effect of the dust after 24 hours. Dinitro-o-cresol (1 per cent.) and dinitro-o-cyclohexylphenol (1 per cent.) gave similar kills in 1–2 days, but 2-chlorfluorene (20 per cent.) was much less effective. In similar tests with *Lygus oblineatus*, Say, the DDT dust killed 96 per cent. of the nymphs and 99 per cent. of the adults in 24 hours and gave complete mortality in 48 hours.

Stevenson (W. A.), Sheets (L.) & Breazeale (J. M.). **Tests with DDT against Pentatomids, Mirids, the Bollworm, and the Cotton Aphid,** p. 143. In field-cage tests in Arizona in 1943, a dust of DDT in pyrophyllite (2 per cent.) killed 50 and 10 per cent., respectively, of the Pentatomids, *Euschistus impictiventris*, Stål, and *Chlorochroa sayi*, Stål, and 100 per cent. of the Capsids, *Creontiades femoralis*, Van D., and species of *Lygus*, on cotton plants, in 24 hours ; 73 and 83 per cent. of the Pentatomids were dead in 48 hours and all in 96 hours. Some plants were wet with rain when dusted, but no injury was caused. In similar tests, mortality of *Heliothis armigera*, Hb., was complete in 46 hours in one cage and very poor in the other. In a small plot of cotton dusted on 26th August, when the temperature was 87°F., the DDT dust and a dust containing 2 per cent. free nicotine gave 41 and 76 per cent. mortality of *Aphis gossypii*, Glov., in 48 hours. Similar treatments on 3rd September, when the temperature was 82°F., gave 5 and 86 per cent. mortality, respectively.

Shiller (I.) & Richmond (C. A.). **DDT for Control of Thrips on Cotton,** pp. 143–144. In preliminary tests in Texas in 1943, young cotton plants heavily infested with *Thrips tabaci*, Lind., and *Frankliniella fusca*, Hinds, of which the former predominated, were given one application of a pyrophyllite dust containing 3 per cent. DDT or a sulphur dust containing 2 per cent. dinitro-o-cyclohexylphenol at the rate of 15 lb. per acre on 19th April, when the average number of thrips per plant was 84·2. The average numbers after 8 and 32 hours, respectively, were 20·1 and 25 for DDT and 58 and 100 for the phenol, as compared with 130 after 32 hours on untreated plants. On other plots dusted with 20 lb. per acre on 23rd April, when the average number of thrips per plant was 144·4, the average numbers after 8 and 32 hours were 5·6 and 4·7 for DDT, 82 and 36·8 for the phenol, and 125 and 85·5 on untreated plants. The dusts were applied in the morning while the plants were moist with dew.

Clark (J. C.). **Tests with DDT against a Stinkbug and the Cotton Leafworm,** p. 144. In cage tests in Texas, pyrophyllite dusts containing 5 and 2 per cent. DDT gave 80 and 66 per cent. mortality of *Chlorochroa ligata*, Say, on cotton plants, and sulphur dust containing 7·5 per cent. Paris green gave 19 per cent. The mortality of untreated bugs was 15 per cent. In a field test, the 2 per cent. DDT dust, used at 5 and 10 lb. per acre gave no mortality of *Alabama argillacea*, Hb., in six days.

Smith (G. L.). **Tests with DDT against the Boll Weevil,** p. 144. Pyrophyllite dusts containing 1 and 2 per cent. DDT, applied to caged cotton plants infested with adults of *Anthonomus grandis*, Boh., during July and August, both gave 16 per cent. net mortality after 96 hours, as compared with 77 per cent. when calcium arsenate was used.

Ingram (J. W.). **Tests of DDT Dust against the Sugarcane Borer, the Yellow Sugarcane Aphid, and the Argentine Ant,** pp. 144–145. A mixture of DDT and pyrophyllite (1 : 1) was compared with synthetic cryolite, and a mixture of synthetic cryolite and sodium fluosilicate (9 : 1) for the control of *Diatraea saccharalis*, F., in Louisiana during September and October on sugar-cane that had been planted early in August and was similar in size and growth to that prevailing in spring at the time of dusting for control of larvae of the first generation. All materials were applied at the rate of 8 lb. per acre per application on 10th and 27th September and 1st and 8th October. Examination of dead

hearts on 29th October showed an average of 1·8, 0·2 and 0·2 borers per plot, respectively, as compared with 7 in untreated plots. The differences required for significance were 2·6 at 19 : 1 and 3·6 at 99 : 1. Examination of the undersides of the leaves on 4th and 11th October showed that *Sipha flava*, Forbes, which sometimes increases to injurious numbers after dusting with synthetic cryolite, was present on an average of 39·2 and 101·8 of the leaves dusted with DDT and on 6 and 17·8 of the leaves of untreated plants ; the average for plants dusted with synthetic cryolite was 40·2 on the later date. The DDT plots could readily be recognised by the unusually large numbers of leaves discoloured by Aphid injury ; predators of the Aphids were abundant on the untreated plots and present on the cryolite plots, but absent from the DDT plots. A thin line of DDT placed across a trail of *Iridomyrmex humilis*, Mayr, in a greenhouse did not deter the ants and apparently caused no ill effects, though this may have been due to the slow action of the insecticide. On 21st October, several puffs of undiluted DDT dust were blown into an unusually large nest of this species ; by the next afternoon, the ants had either abandoned the nest or been killed.

Young (H. C.). **DDT against the White-fringed Beetle and the Velvetbean Caterpillar,** pp. 145–147. In tests in Alabama in which the weevils were caged on the foliage immediately after it had been dusted or sprayed, pyrophyllite dusts containing 0·5 and 1 per cent. DDT caused 8 and 28 per cent. mortality of adults of *Pantomorus leucoloma*, Boh., on cotton leaves and 70 and 72 per cent. on leaves of ground-nut [*Arachis hypogaea*] in 96 hours. Dusts containing 2·5 and 5 per cent. gave practically complete kill on cotton in 96 hours (the few surviving weevils being moribund) and complete kill on ground-nut in 48 hours ; synthetic cryolite gave 14 per cent. kill on cotton and 92 per cent. on ground-nut in 96 hours. A spray containing 2 oz. DDT per 100 U.S. gals. water with a spreading agent gave 76 per cent. mortality on cotton foliage and 100 per cent. on ground-nut in 96 hours, and similar sprays containing 4, 8 and 16 oz. DDT gave complete or practically complete mortality on both plants in the same time. Synthetic cryolite at 12½ lb. per 100 U.S. gals. gave 56 per cent. kill on cotton and 77 per cent. on ground-nut. In tests in which treated weevils were put on untreated foliage, a dust containing 2·5 per cent. DDT and a spray containing 8 oz. DDT per 100 U.S. gals. water gave 45 and 93 per cent. kill in 96 hours ; dusts and sprays of synthetic cryolite and calcium arsenate were less effective. Weevils that were allowed to remain in cages over paper dusted with DDT (1 and 5 per cent.) for an hour and then transferred to untreated ground-nut foliage suffered 61 and 88 per cent. mortality, respectively, in four days ; most of the weevils crawled off the treated paper in a few minutes.

A heavy application of pyrophyllite dust containing 2·5 per cent. DDT to ground-nut plants caused practically complete mortality of weevils placed on the foliage immediately and two and four days later. A heavy application of a spray of 8 oz. DDT and 3 U.S. pints raw linseed oil per 100 U.S. gals. water killed 100, 92, 78 and 57 per cent. of beetles put on the foliage 0, 2, 4 and 8 days later, and 7 per cent. of those put on shoots bearing both treated foliage and new growth 15 days later. The corresponding percentage mortalities for a very heavy application of 8 lb. DDT, 40 lb. raw linseed oil and 4 lb. triethanolamine per 100 U.S. gals. spray were 100, 100, 100, 77 and 59. These two sprays gave 56 and 98 per cent. mortality of weevils put on shoots, from which untreated growth had been removed, 15 days after treatment.

In the laboratory, dusts of 2·5 per cent. DDT in pyrophyllite and of cryolite and wheat flour (9 : 1) gave complete mortality of half-grown larvae of *Anticarsia gemmatalis*, Hb., on ground-nut foliage in 48 and 96 hours, respectively. One application of 58 U.S. gals. per acre of a spray containing 8 oz. DDT and 3 U.S. pints raw linseed oil per 100 U.S. gals. water on 14th September prevented further defoliation of velvet beans [*Stizolobium*] by *A. gemmatalis*, whereas untreated plots were completely defoliated by 22nd September, and a second

application on 24th September protected the new foliage from migrating larvae, although these were active for several weeks later.

This spray and a dust of equal quantities of DDT and pyrophyllite caused no foliage injury to cotton, cowpea, ground-nut, soy bean, tomato, velvet bean and 11 species of herbaceous flowering plants and weeds ; no rain fell for ten days after the applications.

Tenhet (J. N.). **DDT to control the Tobacco Moth and the Cigarette Beetle,** pp. 147–148. In experiments with DDT as a substitute for pyrethrum in the control of *Ephestia elutella*, Hb., and *Lasioderma serricorne*, F., in open-type tobacco warehouses, oil sprays containing 3 or 5 per cent. DDT or pyrethrum extract (0·2 per cent. total pyrethrins) were atomised at the rate of 75 cc. per 1,000 cu. ft. into modified Peet-Grady chambers containing 25 newly emerged adults of each species, reared under controlled conditions and selected at random. After exposure for 15 minutes, the chambers were airwashed by means of an exhaust fan for 15 minutes, and the insects were then put in wire-gauze cages for observations. For *Ephestia*, the percentages paralysed after 24 hours were 90, 98 and 95, the percentages dead after three days 94, 100 and 96, and the numbers of eggs deposited in three days 1,298, 1,039 and 1,202, respectively ; for *Lasioderma*, the percentages paralysed after 24 hours were 28, 50 and 24, and the percentages dead after five days 44, 66 and 36, respectively. There was no decrease in the number of paralysed insects in cages sprayed with DDT, indicating that they seldom recovered; the mortality of unsprayed insects increased sharply after the first 24 hours. No deleterious effects were noted from the handling of DDT or from breathing the atomised spray. Adults of *Lasioderma* kept for 2, 3 and 3 days in wire-gauze cages that had been treated 0·2, 9 and 37 days before with the spray containing 5 per cent. DDT and allowed to dry suffered 100, 96 and 92 per cent. mortality, respectively. Adults of *Ephestia*, put in the cages 2, 2, 9 and 37 days after spraying and kept there for 0·2, 3,3 and 3 days, respectively, suffered 72, 100, 100 and 76 per cent. mortality; larvae of this species, put in the cages 14 days after spraying and kept there for 15 days, were unaffected.

Chamberlin (F. S.). **Cage Tests with DDT against certain Insects affecting Tobacco,** p. 148. A dust containing 5 per cent. DDT gave complete mortality of 100 adults of *Epitrix parvula*, F. (*hirtipennis*, Melsh.), caged on small tobacco plants, in 24 hours. One containing 3 per cent. gave complete mortality of second- and third-instar larvae of *Protoparce sexta*, Joh., on growing tobacco plants under cages in 48 hours, the larvae consuming very little of the dusted foliage. In three tests of the latter dust against adults of *Nezara viridula*, L., on pea and okra [*Hibiscus esculentus*], the mortality percentages on treated and (in brackets) untreated plants were 86 (54) in three days and 75 (28) and 72 (38) in five days.

Hinman (E. J.). **Laboratory Cage Tests of DDT in Grasshopper Baits,** p. 148. Adults of *Melanoplus mexicanus*, Sauss., with small numbers of *M. bivittatus*, Say, and *M. femur-rubrum*, Deg., were collected in the field, kept overnight without food and then put in cages containing bait prepared by mixing 4 lb. sodium fluosilicate, 4 lb. DDT or 3 lb. DDT with 100 lb. wheat bran or by dissolving 4 lb. DDT in enough acetone to moisten the bran and spreading the treated bran thinly for a night to allow the acetone to evaporate ; enough water to make a moist mash was added to each mixture just before it was used. The grasshoppers appeared to feed on all the baits alike, and the average mortalities were 78, 33, 24 and 35 per cent. after one day and 100, 57, 62 and 83 per cent. after three days. The DDT baits were definitely toxic, but significantly inferior to the sodium-fluosilicate bait ; there was no significant difference between the two dry-mixed DDT baits, but that prepared with acetone was significantly more effective, indicating that a better bait may result from more even distribution of the compound in the carrier.

Wilson (C. C.). **Efficiency of DDT as a Dust and in Bait for Grasshopper Control,** pp. 148–149. The results are given of field tests carried out in August against infestations of 10–30 adults of *Melanoplus mexicanus devastator*, Scud., *M. bivittatus*, Say, and *Camnula pellucida*, Scud., per sq. yard. In preliminary small-scale tests in California, pyrophyllite dust containing 50 per cent. DDT, applied to lucerne, 14–20 ins. tall, infested with *M. m. devastator* and *M. bivittatus*, caused at least 90 per cent. mortality in 24 hours, and a similar dust containing 10 per cent. DDT killed about 15 per cent. in dense lucerne but none in open spaces. No scorching of foliage was observed. In green lucerne, 2–6 ins. tall, in Nevada, a bait containing 3 lb. DDT per 100 lb. carrier (usually wheat bran) was approximately equal in effectiveness to one containing 1 U.S. quart sodium-arsenite solution (32 per cent. As_2O_3), but one containing 2 lb. DDT was significantly less effective. In a field containing sparse lucerne stems and matted dry grass, a bait containing 3 lb. DDT was practically as efficient as one containing 1½ U.S. quarts sodium-arsenite solution. In other field experiments, 3 lb. DDT per 100 lb. bran was 24 per cent. more effective in green lucerne and 13 per cent. less so in dry lucerne than 3 lb. sodium fluosilicate per 100 lb. The bait containing DDT killed the grasshoppers at approximately the same rate as the sodium-fluosilicate bait and much more quickly than that containing sodium arsenite, especially where the grasshoppers had been feeding on succulent vegetation.

Questel (D. D.). **DDT as a Substitute for Derris against the European Corn Borer,** pp. 149–150. In preliminary laboratory tests carried out in Ohio, sprays containing (per 100 U.S. gals. water) 4, 2, 1 and ½ lb. of a proprietary mixture containing 5 per cent. DDT and a small amount of wetting agent gave 100, 99, 97, and 71 per cent. mortality of larvae of the European corn borer [*Pyrausta nubilalis*, Hb.]; sprays containing 1 and ½ lb. ground derris root (4·8 per cent. rotenone) gave 100 and 81 per cent. In field tests on sweet maize, a spray containing 6 lb. DDT mixture gave 92 and 96 per cent. reduction of borers in the plants and ears, respectively, and one containing 4 lb. ground derris root (4·7 per cent. rotenone) gave 96 and 98 per cent. Sprays containing 2, 4, 6 and 8 lb. DDT mixture, applied before the regular spraying season, caused no injury to the maize plants.

Weigel (C. A.). **DDT against some Pests of Vegetable Crops,** p. 150. Radish plants infested with *Myzus persicae*, Sulz., radish and bean plants infested with mites of the genus *Tetranychus*, and *Coleus* infested with mealybugs (*Pseudococcus citri*, Risso) were exposed for 2½ hours in a fumigation chamber with a capacity of 16 cu. ft. into which 34 gm. of an aerosol containing 2 per cent. (by weight) DDT in methyl chloride had been released. Examination after 48 hours showed 86 per cent. mortality of the Aphids, 6 per cent. of the mites on bean and 20 per cent. of those on radish, and 6 per cent. of the mealybugs; the eggs of the mites were not affected. Similar treatment with an aerosol containing 2 per cent. DDT and 4 per cent. orthodichlorbenzene in methyl chloride caused 98 per cent. mortality of the Aphids, 67 per cent. of the mites and 25 per cent. of the mealybugs (chiefly nymphs) based on examination after three days. The eggs of the mites and mealybugs were not affected, and slight injury occurred on the *Coleus* cuttings only.

The mortality of *Tetranychus* on a bean plant sprayed with 4 lb. of a mixture containing 5 per cent. DDT per 100 U.S. gals. water was apparently 13 per cent. after 48 hours and 5 per cent. 8 days later, some of the affected mites having presumably recovered. Similar treatment of cuttings of snapdragon (*Antirrhinum*) infested with *M. persicae* caused 38 per cent. mortality in 48 hours. Neither bean nor snapdragon plants were injured. A dust containing 3 per cent. DDT killed 51 per cent. of the Aphids and 12 per cent. of the mites in 4 days. In greenhouse tests in which adults of *Leptinotarsa decemlineata*, Say, were caged with potato cuttings that had been treated with DDT, the 3 per cent. dust gave practically complete mortality in 48 hours and complete mortality in

72 hours ; a spray containing 8 lb. 5 per cent. DDT per 100 U.S. gals. water killed all the beetles in 4–7 days ; one containing 6 lb. was less effective. Further tests in the greenhouse and in outdoor cages gave similar results against the adults, but the larvae were killed more rapidly ; no plant injury was observed. In tests in which adults of *Epitrix cucumeris*, Harr., were caged with treated potato cuttings, the 3 per cent. dust gave complete mortality in 24 hours with slight yellowing of the leaves within 4 days, and the spray containing 4 lb. DDT mixture gave complete mortality in 72 hours with no plant injury. Neither the dust nor the stronger spray caused any mortality in 24 hours of adults or larvae of *Epilachna varivestis*, Muls., caged on treated bean plants in the greenhouse ; none of the larvae died within 7–10 days.

Schopp (R.) & Brindley (T. A.). **Tests with DDT against the Pea Weevil,** pp. 150–151. In tests in Idaho in which adults of *Bruchus pisorum*, L., from stored peas were dusted in a bell jar with 0·3 gm. of a dust containing 10 per cent. DDT or 0·15 gm. of one containing 2 per cent., transferred to cages after 5 minutes and kept for 10 days at 86°F., the percentage mortalities were only 62 and 11, respectively, as compared with 3 and 8 for undusted Bruchids.

Harries (F. H.). **Laboratory Tests with DDT against the Pea Aphid and the Mexican Bean Beetle,** p. 151. In a series of tests carried out in Ohio in December 1942 and January 1943, the mortality of third-instar larvae of *Epilachna varivestis*, Muls., that were fed on bean leaves dusted with pyrophyllite containing 3 per cent. DDT and kept for 72 hours at 80°F. and 50 per cent. relative humidity, varied from 0 to 100, but averaged 36 ; a dust of derris and pyrophyllite (0·5 per cent. rotenone) gave 70 per cent. mortality. In later tests, a dust containing 10 per cent. DDT killed fewer larvae than one containing 0·5 per cent. rotenone, though the DDT had no appreciable repellent effect. Dusts containing from 0·0781 to 10 per cent. DDT in pyrophyllite, applied to pea plants infested with *Macrosiphum onobrychis*, Boy. (*pisi*, Kalt.), caused 88–100 per cent. mortality of wingless adults and permitted the survival of 0–22·6 progeny per plant ; derris and pyrophyllite (0·5 per cent. rotenone) killed 83 per cent. and allowed the survival of 15·2 young per plant. DDT killed both insects much faster than derris and caused no injury to either plant.

Nelson (R. H.). **Field Experiments on DDT for Control of the Mexican Bean Beetle,** p. 151. Examination of field plots of beans infested with *Epilachna varivestis*, Muls., made 14 days after a single application of 23 lb. cubé dust (0·5 per cent. rotenone) or 26 lb. pyrophyllite dust containing 10 per cent. DDT per acre, showed 10 and 44 per cent. defoliation, respectively, as compared with 92 per cent. on untreated beans, and 49 and 273 surviving larvae and pupae as compared with 318 on untreated plots ; 12 days after the second of two applications of the cubé dust at 36 lb. per acre and the DDT dust at 35 lb., the respective defoliation percentages were 3 and 55, as compared with 71, and the survival numbers 17 and 840, as compared with 917. It is concluded that DDT is not very effective against *E. varivestis*.

Johnson (G. V.). **DDT for Control of the Tomato Fruitworm,** pp. 151–152. The percentages of tomatos injured by *Heliothis armigera*, Hb., on plants dusted with pyrophyllite containing 3 and 1 per cent. DDT and with undiluted calcium arsenate, all applied at the rate of 30 lb. per acre on 10th and 24th August and 8th September, were 4, 8 and 6·5, as compared with 28·5 on untreated plants. Analysis of the results showed that 1 per cent. DDT was not significantly less effective than undiluted calcium arsenate, but that 3 per cent. DDT was significantly more so. In laboratory tests, in which 30 larvae of *H. armigera* were fed with leaves dusted with 69 mmg. per sq. cm. of 3 per cent. DDT, 42 mmg. 5 per cent. DDT prepared commercially for use in spray mixtures, or 15 mmg. calcium arsenate, 30, 29 and 25 larvae were killed, respectively ; more feeding took place on calcium arsenate than on DDT.

Howard (N. F.). **Field Experiments with DDT against the Potato Leafhopper and the Turnip Aphid,** p. 152. In small plots in Ohio, a mixture of DDT, Bancroft

clay and sulphur (1 : 19 : 80) was as effective as one of pyrethrum and sulphur containing 0·025 per cent. total pyrethrins agaist *Empoasca fabae*, Harr., on potato and bean ; undiluted sulphur and Bordeaux mixture were less effective. Two applications of a dust of 1 per cent. DDT in pyrophyllite at 119 lb. per acre, a derris dust containing 1 per cent. rotenone and 2 per cent. oil at 98 lb. per acre or a nicotine-sulphate dust containing 3 per cent. nicotine at 65 lb. per acre were made to large turnip plants heavily infested with *Rhopalosiphum pseudobrassicae*, Davis, and the Aphids were counted on four 1-inch sections of each of five random leaves of each plot 48 hours after the second application. The numbers surviving were 43, 18 and 8 on the treated plots, as compared with 412 on undusted leaves.

Smith (C. E.) & Harrison (P. K.). **Field Tests with DDT and other Insecticides against Cabbage Caterpillars,** pp. 152–153. The authors describe small-plot tests of a number of treatments for the control of caterpillars attacking autumn-grown cabbage, carried out in Louisiana in 1943. Random examination of 100 cabbage plants on 27th October revealed the presence of 100 young larvae, principally *Plusia* (*Autographa*) *brassicae*, Ril., but also including *Pieris rapae*, L., *Plutella maculipennis*, Curt., *Heliothis armigera*, Hb., and climbing cutworms. The insecticides were applied on 29th October and 5th November. Examination five days after the second application showed 6 larvae per 100 plants on the plot treated with 14 lb. per acre of DDT in pyrophyllite (1 : 10), 61 on that treated with 14 lb. pyrethrum in pyrophyllite (0·3 per cent. total pyrethrins) and 74 on that treated with 18 lb. derris in pyryophyllite (0·5 per cent. rotenone). These differences were not significant, but the other dusts tested and a number of sprays were significantly less effective than the DDT dust. On plants that were treated with the DDT dust at the rate of 18 lb. per acre on 12th November, some insects were affected 2 hours after treatment, and several of these were dead after 20 hours. After 3 days, there were 8 living and 15 dead larvae and pupae of *Plusia brassicae*, 2 living and 20 dead adults of the banded cucumber beetle [*Diabrotica balteata*, Lec.] and 2 and 4 living larvae or pupae of *Pieris* and *Plutella*, respectively, on 200 dusted plants ; undusted plants had large populations of *Plusia brassicae* and small ones of the other species.

Harrison (P. K.). **Tests of DDT for Cabbage Insects and Squash Bugs,** pp. 153–154. The results are given of preliminary insectary tests of dusts containing 10 per cent. DDT, 20 per cent. 2-chlorfluorene, 0·75 per cent. rotenone as derris or 20 per cent. flour of yam bean [*Pachyrhizus erosus*] against several insects that commonly attack cabbage and against squash bugs (species of *Anasa*), on a number of food-plants, including cabbage, squash, cowpea, and okra [*Hibiscus esculentus*], carried out in Louisiana in July–September 1943. DDT killed 100 per cent. of adults of *Murgantia histrionica*, Hahn, and larvae of *Evergestis rimosalis*, Gn., 76–100 per cent. of adults and nymphs of *Nezara viridula*, L., 90 per cent. of larvae of *Pieris rapae*, L., and 94–100 per cent. of adults and nymphs of species of *Anasa* in 2–7 days. Chlorfluorene gave high kills of all the insects and derris of all but *N. viridula* (24 per cent.). Yam-bean flour gave 80 per cent. kill of *N. viridula*, but was relatively ineffective against the other insects.

Smith (F. F.). **DDT to Control Thrips on Gladiolus,** pp. 154–155. In tests carried out in Maryland in 1943 on the control of *Thrips tabaci*, Lind., on onions, sprays of 2 lb. tartar emetic and 4 lb. brown sugar per 100 U.S. gals. water resulted in significantly higher yields than any other treatment. Sprays of 7½ lb. of a material containing 5 per cent. DDT alone, with 4 lb. brown sugar and with 4 U.S. gals. deodorised kerosene and 8 lb. soap per 100 U.S. gals. were significantly more effective than the kerosene and soap without DDT or no treatment. On two varieties of gladiolus, the three DDT sprays did not differ significantly from the tartar-emetic spray in the control of *Taeniothrips simplex*, Morison, as determined from the degree of subsequent injury to the lower florets on flower spikes, but DDT alone and with sugar left a slight white deposit

and apparently caused scattered rusty-brown spots, and the two oil sprays caused severe yellowing and death of many plants of one variety and less severe injury to the other ; the oil emulsion seemed to cause more injury without DDT than with it.

Fleming (W. E.) & Chisholm (R. D.). **DDT as a protective Spray against the Japanese Beetle,** p. 155. In laboratory tests, a spray containing 4 oz. DDT and 4 oz. calcite, made into a thin paste with fish glue, and 0·125 U.S. pints commercial summer-oil emulsion (83 per cent.) per 100 U.S. gals. water was as effective as sprays containing 6 lb. lead arsenate in protecting *Polygonum pennsylvanicum* from attack by adults of *Popillia japonica*, Newm. In field tests, one application of the DDT spray protected the fruit and foliage of early varieties of peach trees for ten days, or as long as two applications of the recommended spray of ground derris root and resin residue emulsion [*cf.* **30** 551]. A single application at four times this strength protected them throughout the period of beetle attack ; the presence of large numbers of dead beetles under the sprayed trees indicated that the DDT acted as a poison. One application at the higher rate to plum trees destroyed a heavy infestation and kept the trees free from attack for the rest of the season, though peaches and nectarines in the immediate vicinity were severely attacked, and one practically eliminated an infestation on grape-vines, though adjacent unsprayed vines were heavily infested. There was no evidence of injury to the fruit or foliage of peach, plum or grape.

Steiner (L. F.), Arnold (C. H.) & Summerland (S. A.). **Laboratory and Field Tests of DDT for Control of the Codling Moth,** pp. 156–157, 1 ref. In preliminary laboratory tests in Indiana, apples were sprayed with DDT, alone or mixed with pyrophyllite or certain fungicides, adhesives and spreaders, and exposed to attack by ten newly-hatched larvae of *Cydia* (*Carpocapsa*) *pomonella*, L., per apple. DDT at 1 lb. per 100 U.S. gals. appeared to be significantly more effective than lead arsenate at 3 lb., giving nearly perfect control. Spreaders or supplements containing wetting agents did not usually reduce the initial kill, but reduced the effectiveness after the deposits had been exposed to additional sprays of tap water, applied to simulate weathering ; and adhesives, such as mineral oil, bentonite, or weak Bordeaux mixture did not increase the resistance to weathering. Both initial efficiency and resistance to weathering were very poor when the DDT was dissolved in acetone and reprecipitated in a mixture containing flocculated bentonite and a soy-bean phosphatide spreader [*cf.* **31** 397]. In further tests, in which samples of apples were taken from trees before and after each spray and exposed to the attack of ten newly-hatched larvae per apple, sprays of 1 lb. DDT per 100 U.S. gals. were highly effective (approximately 90 per cent. or more) even after long periods of weathering ; the maximum effectiveness of the standard lead arsenate treatment was only 69·8 per cent. Other tests suggested that DDT could be used effectively after sprays of either nicotine bentonite with soy-bean oil or lead arsenate and lime with mineral oil against the first generation. The addition of 0·5 per cent. mineral oil and 1 lb. bentonite per 100 U.S. gals. did not improve the control given by DDT. Bordeaux mixture (1 : 2 : 100) had no adverse effect until 2–4 weeks after the final spray, when the percentage of uninjured apples fell from 99 to 78 after 2·31 ins. rain ; the decline on the plots where no supplements were used was only half as great. In tests in which 2,500 eggs were deposited by caged moths before and after spraying with 1½ lb. DDT in 100 U.S. gals., no ovicidal effect could be detected ; neither the deposits nor the sprays appeared to be toxic to the moths.

On apple trees that had received a series of lead-arsenate sprays by 21st July (near the peak of hatching of the second generation), when the number of stings [superficial injuries] and entrances per 100 apples were 34 and 15, respectively, sprays of nicotine bentonite on 22nd July and 12th and 28th August resulted in 81 stings and 107 entrances at harvest ; sprays of 3 lb. lead arsenate in 100 U.S. gals. Bordeaux mixture (½ lb. copper sulphate and 1 lb. lime) resulted in 104

and 85 when applied on the same dates and 96 and 109 when the last application was omitted, and sprays of 12 and 24 oz. DDT, mixed with equal quantities of pyrophyllite, per 100 U.S. gals. water, applied on the same three dates, gave 51 and 56 stings and 31 and 12 entrances. Hatched eggs were numerous on the plot that received the heavier DDT spray, indicating that the ovipositing moths did not avoid these trees. In July, *Paratetranychus pilosus*, C. & F., became noticeably more abundant on trees sprayed with DDT than on trees receiving other sprays or no treatment, as many as 40 mites and 100 unhatched eggs being found on a single leaf. On 24th August, if was noticed that the predacious Coccinellid, *Stethorus punctum*, Lec., was absent from the DDT plots, but numerous on adjacent lead-arsenate and nicotine plots ; subsequently, it migrated to the DDT plots and controlled the outbreak. At harvest, however, mites of the genus *Tetranychus* were numerous on the fruit and under the bark of all trees sprayed with DDT, while they were difficult to find on all other trees. One variety of apple showed no spray injury, but another developed irregular dead patches between the veins of nearly a quarter of the leaves, which turned yellow or dropped, and this may have been due to DDT. The injury appeared on most of the trees sprayed with it by 24th August, but was later on two of them, which had been sprayed with nicotine bentonite before 6th July ; all the foliage gradually became a lighter green than that on unsprayed trees, and leaf loss approximated 75 per cent. by the beginning of October, as compared with 10 per cent. on unsprayed trees. The injury may have been caused or aggravated by the increased mite population and extremely hot dry weather between 6th July and 2nd September ; it was as serious on trees that received two sprays of 1 lb. DDT per 100 U.S. gals., the second on 27th July as on those that received five applications until 12th August.

Siegler (E. H.). **Laboratory Tests of DDT against the Codling Moth,** pp. 157–158. DDT was tested alone and with other spray materials against newly-hatched larvae of *Cydia* (*Carpocapsa*) *pomonella*, L., by the apple-plug method [*cf.* **23** 174]. All quantities given are per 100 U.S. gals. spray. When used alone the DDT was dissolved in ethanol with gentle heating and then precipitated by adding water to make a 20 per cent. ethanol carrier. When used with other materials, it was merely ground and mixed with them and water was used as the carrier. DDT alone resulted in 16, 6, 1 and 1 entries and 12, 12, 3 and 1 stings when used at 1, 2, 3 and 4 lb. ; at $\frac{1}{4}$ and $\frac{1}{2}$ lb. it was ineffective. Plugs exposed 6 and 9 days after treatment with 2 lb. DDT and others exposed 5 and 6 days after treatment with 4 lb. showed 11, 18, 0 and 5 entries and 2, 10, 3 and 5 stings, respectively. The addition of Bordeaux mixture (4 : 8 : 100) or $\frac{1}{4}$ lb. neutral fish-oil soap to 2 lb. ground DDT or of 2 oz. diglycol stearate or 6 lb. pyrophyllite to 3 lb. caused little or no reduction in the efficiency of the spray, but the addition of 8 lb. bentonite, 1 U.S. gal. lime-sulphur or 6 lb. each of hydrated lime and wettable sulphur to 2 lb. DDT or of 6 lb. hydrated lime to 3 lb. reduced the toxicity somewhat. In these tests, 93 per cent. of untreated plugs and 44 per cent. of those sprayed with 4 lb. lead arsenate were entered and 0 and 5 per cent. were stung. In small-scale field tests, a single application of 4 lb. each of DDT and pyrophyllite per 100 U.S. gals. water caused no injury to apple and moderate injury to peach ; one of 3 lb. DDT with Bordeaux mixture (4 : 8 : 100) caused moderate injury to apple ; one of 3 lb. DDT and 6 lb. each of wettable sulphur and hydrated lime caused none to apple or peach ; and one of 4 lb. DDT caused severe foliage injury to grape-vine.

Schaffner jr. (J. V.). **Tests of DDT as a Contact Insecticide against Females of the Fall Cankerworm,** p. 158. In field tests in Connecticut, the trunks of a few trees in a stand of mixed hardwoods were banded with burlap that had been saturated with an emulsion containing 5 per cent. DDT, sprayed with the emulsion for about 4 ft. above ground level, or dusted to the same height with equal quantities of DDT and pyrophyllite, for the control of a severe infestation of the fall cankerworm [*Alsophila pometaria*, Harr.] discovered in November

1943. These tests were supplemented by others in the laboratory. The dust killed moths that came in contact with it for a very short period of time ; they did not die immediately, but quickly lost all power of locomotion. The emulsion was not very effective in the field, but moths confined in cages that had been sprayed with it soon lost all power of movement and died within 24–48 hours.

Plummer (C. C.). **DDT and the Mexican Fruitfly,** p. 158, 1 fig., 1 ref. Brief notes are given on laboratory tests with a spray prepared by dissolving DDT in 20 ml. acetone and making the quantity up to 200 ml. by adding a solution containing 20 lb. granulated sugar and 1 lb. dried Chinese egg albumen per 100 U.S. gals. water, for the control of adults of *Anastrepha ludens*, Lw., by a technique already noticed [*cf.* **31** 276]. When DDT was used at the rate of 8 lb. per 100 U.S. gals., small needle-like crystals of DDT were thrown into suspension, but at ½, 1, 2 and 4 lb., the suspensions appeared to be fine and amorphous ; microscopic examination of dried deposits showed the presence of small round masses of DDT on plates treated with 2, 4 and 8 lb. DDT per 100 U.S. gals., but even distribution on those treated with ½ and 1 lb. The toxicity of DDT was more erratic than that of any other compound that has been tested against this fruit-fly. All flies exposed to 2 and 4 lb. DDT died within 33 days, but 2 of 247 exposed to ½ lb., 4 of 248 exposed to 1 lb. and 17 of 250 exposed to 8 lb. survived. All but four of the surviving flies were females. A similarly prepared solution of 2 lb. tartar emetic was considerably more toxic than any of the concentrations of DDT tested.

Holst (E. C.). **DDT as a Stomach and Contact Poison for Honeybees,** p. 159, 1 ref. Honey-sugar syrup, dilute honey and queen-cage candy containing 0·05 per cent. DDT killed the majority of drones and worker bees fed on them within 17–42 hours. Lack of locomotor control appeared several hours after feeding, but no internal or external changes in appearance were found to differentiate bees dying from this cause. Bees kept in cages previously sprayed with 0·05 per cent. DDT or sprayed directly with this concentration were unaffected, but most of those in cages previously sprayed with 1 and 2 per cent. DDT died within 6 hours, and the rest were obviously poisoned. It is concluded that DDT is a stomach poison for honey-bees at a concentration of 0·05 per cent. and a contact poison at 1 per cent.

Forsslund (K. H.). **Nordliga öronviveln—en skadegörare på barrträdens groddplantor i Norrland.** [The northern broad-nosed Weevil, a Pest on Conifer Seedlings in northern Sweden.]—*Skogen* **28** pp. 253–255. Stockholm, 1941. (Abstr. in *For. Abstr.* **5** no. 3 p. 201. Oxford, 1944.)

From investigations on the influence of animal life on natural regeneration of conifers, the author has found that the young seedlings are attacked by a number of insects, mainly polyphagous weevils and moth larvae that usually feed on leaves of bilberry (*Vaccinium myrtillus*). The adults of *Otiorrhynchus nodosus*, Müll. (*dubius*, Strom), which is common in forests that contain bilberries, attack the stalks of the seedlings and the larvae feed on the roots.

Dodge (B. O.). **The Sycamore Plant Bug.**—*J.N.Y. bot. Gdn* **44** pp. 214–215. Lancaster, Pa., 1943. (Abstr. in *For. Abstr.* **5** no. 3 p. 203. Oxford, 1944.)

Injury to the leaves of American plane (*Platanus occidentalis*) by *Plagiognathus albatus*, Van D., has been observed in New York Botanical Gardens for several years during June. Numerous whitish specks appear on both sides of the leaves, and many irregular, angular holes apparently result from a shrinkage of the leaf tissue following an injection of a poisonous substance by the Capsid. It also occurs on London plane (*Platanus acerifolia*), but the damage is less severe and is largely confined to a few leaves at the tips of the branches.

Fitzgerald (L. R.). *Phoma stenobothri*, **a Fungus Parasite of the Grasshopper.**—*Amer. Midl. Nat.* **29** no. 3 pp. 761–767, 1 pl., 6 figs., 4 refs. Notre Dame, Ind., 1943.

A fungus, *Phoma* (*Isaria*) *stenobothri*, previously known from European grasshoppers, has been found infesting *Melanoplus differentialis*, Thos., kept in cages at Iowa University. The grasshoppers ceased to feed and their limbs were paralysed. No morphological symptoms were observable in them, but at the time of death, the fungus cells were present in the haemolymph and haemocytes and some of the latter appeared to be destroyed. Muscles suffered disintegration. Stages in the development of the fungus and a method of infesting grasshoppers by injection of spores are described.

Ivanoff (S. S.). **Resistance of Cantaloupes to Downy Mildew and the Melon Aphid.**—*J. Hered.* **35** no. 2 pp. 35–39, 1 pl., 2 figs., 2 refs. Baltimore, Md., 1944.

The following is taken from the author's summary. Four varieties of cantaloupe melon of West Indian origin have shown resistance to downy mildew (*Peronoplasmopara cubensis*) and to *Aphis gossypii*, Glov., in southern Texas. Crosses have been made between these and non-resistant commercial varieties in order to develop a type resistant to both fungus and Aphid [*cf. R.A.E.*, A **30** 228]. Such resistance appeared in the F_1 generation as partly dominant. Highly resistant lines, however, have been isolated in later generations that combined disease and insect resistance with shipping and other qualities.

Ruffinelli (A.). **La** *Diatraea saccharalis* **(F.) en el Uruguay.**—*Rev. Asoc. Ing. agrón.* **15** no. 2 pp. 19–24, 7 figs. Montevideo, 1943. (With a Summary in English.) (Abstr. in *Exp. Sta. Rec.* **90** no. 6 p. 804. Washington, D.C., 1944.)

Diatraea saccharalis, F., is a relatively new pest in Uruguay, and it is the only species injurious to sugar-cane and maize. Its biology under local conditions is described ; it is parasitised by *Ipobracon* sp.

Schneider (B. A.). **Factors influencing the inherent Vitality of the Adult Flour Beetle,** *Tribolium confusum* **Duval.** (Abstract.)—*Anat. Rec.* **78** Suppl. p. 167. Philadelphia, Pa., 1940. [Recd. 1944.]

The larval stage of *Tribolium confusum*, Duv., was shorter and the periods for which the resulting adults survived starvation were longer if the larvae were reared at a density of 100 per 100 gm. food or were the offspring of parents six months old than if they were reared at a density of 300 per 100 gm. or were the offspring of parents one month old. Vitality, estimated by resistance to starvation, was very slightly greater in adults that were 20 days old than in those that had just emerged. It decreased progressively in adults that were 125 and 220 days old.

Dreyer (W. A.). **Weight and total Water Content of the Flour Beetle (***Tribolium confusum* **Duval) in Relation to Temperature and Humidity.** (Abstract.)—*Anat. Rec.* **78** Suppl. pp. 169–170. Philadelphia, Pa., 1940. [Recd. 1944.]

The weight and total water content of adults of *Tribolium confusum*, Duv., living under different conditions of temperature and moisture were determined as a measure of metabolic activity while feeding and starving. The body weight

of 25 beetles varied from 43·2 to 50·2 mg. Total water content ranged from 68·6 to 83·3 per cent. of body weight. Starving beetles lost more weight at low relative humidities than at high ones, at either 10 or 24°C. [50 or 75·2°F.]. There was no difference in the total water content of starving or feeding beetles kept at either temperature or humidity.

Pearl (R.), Park (T.) & Miner (J. R.). **Experimental Studies on the Duration of Life. XVI. Life Tables for the Flour Beetle** *Tribolium confusum* **Duval.** (Abstract.)—*Anat. Rec.* **78** Suppl. p. 170. Philadelphia, Pa., 1940. [Recd. 1944.]

Life-tables were constructed for 400 males and 400 females of *Tribolium confusum*, Duv., living in regularly renewed fresh flour. The mean duration of life is 177·80±2·83 days for males and 198·50±3·48 days for females. The longest life span was 540 days for a male and 435 days for a female.

Park (T.). **Inter-species Competition within Populations of the Genus** *Tribolium*. (Abstract.)—*Anat. Rec.* **87** no. 4 p. 462. Philadelphia, Pa., 1943.

Experiments have been begun on the growth and maintenance of populations of *Tribolium confusum*, Duv., and *T. castaneum*, Hbst., when they are cultured separately or in competition with one another under four different flour-volume relationships, with the environmental conditions as favourable and as controlled as possible. Preliminary findings are that *T. castaneum* produces larger total populations than *T. confusum*, although the cultures of the latter have a higher percentage of adults ; that cycles of growth are evident for both species ; that interspecific competition reduces the total population size ; and that *T. castaneum* appears to be the more successful competitor in the population (statistical) sense.

Park (T.) & Davis (M. B.). **Further Analysis of Fecundity in the Flour Beetles,** *Tribolium confusum* **Duval and** *Tribolium castaneum* **Herbst.** (Abstract.)—*Anat. Rec.* **87** no. 4 p. 463. Philadelphia, Pa., 1943.

Analysis of records of oviposition over a period of 60 days shows that the fecundity rate of *Tribolium confusum*, Duv., is significantly higher (by about 6 per cent.) than that of *T. castaneum*, Hbst. The variability is also greater for *T. castaneum*. A stock of *T. castaneum* showing an increase of 15 per cent. in fecundity rate was obtained by selection, but it was not possible to do this with *T. confusum*. Analysis of variance of the total data shows that there is more variability in respect of fecundity between pairs of beetles than within pairs.

Narasimhan (M. J.) & Krishna Murthy (B.). **Burnt Paddy-husk for the Control of Insects in stored Food Grains.**—*Curr. Sci.* **13** no. 6 p. 162, 2 refs. Bangalore, 1944.

Since various mineral dusts have been shown to be effective against *Calandra granaria*, L., when mixed with wheat [*cf. R.A.E.*, A **32** 311], the authors carried out experiments in Bangalore on the value of burnt rice husk in the control of *C. oryzae*, L., in sorghum, *Rhizopertha dominica*, F., and species of *Tribolium* in rice and wheat and *Bruchus chinensis*, L., in horse-gram [*Dolichos biflorus*]. The finely powdered husk adhered readily to the grains when thoroughly mixed with them. In the laboratory, 100 per cent. mortality of adults was obtained with *R. dominica* and *B. chinensis*, 86·3 per cent. with *C. oryzae*, and 68·4 per cent. with *Tribolium*. The larvae of *Tribolium* and *Bruchus* were also affected in their channels in the seeds. When mixed with sound grain, the powder repelled the insects to a marked degree. The grain was easily freed from it by the usual winnowing and cleaning process.

Hem Singh Pruthi. **War against Locusts in India.**—*Curr. Sci.* **13** no. 7 pp. 174–176. Bangalore, 1944.

The outbreak of *Schistocerca gregaria*, Forsk., which started in India in 1940 [*R.A.E.*, A **30** 303], continued in 1941–44. Its development year by year is summarised, and the organisation for its control is briefly described.

Jones (S.). **An interesting Case of Diapause in the Caterpillars of the Cardamom Root-borer, *Hilarographa caminodes* Meyr.**—*Curr. Sci.* **13** no. 7 p. 188, 4 refs. Bangalore, 1944.

During preliminary observations on the insect pests of cardamom [*Elettaria cardamomum*] in Travancore, many of the fully-fed larvae of the Tinеid *Hilarographa caminodes*, Meyr., that had penetrated into the rhizome from the roots were found to remain in diapause from February until April–May, when the rains began. Larvae in the roots pupated without delay. Recent work on the factors that cause diapause in certain insects [*R.A.E.*, A **30** 341, 448; **31** 349] is briefly reviewed. In this case, as in that of *Platyedra gossypiella*, Saund. [**28** 532], the nutrition of the larvae is thought to be responsible. The phenomenon did not appear in the wet season, and it is probable that hot, dry weather conditions brought about some change in the tissues of the plants on which the larvae fed.

Gardner (J. C. M.). **Entomological Notes.**—*Indian For.* **69** no. 8 pp. 323–324. Dehra Dun, 1943.

These notes include recommendations for preserving logs of *Boswellia serrata*, a tree of importance for box wood in India, from attack by *Atractocerus reversus*, Wlk. The felled logs can maintain the bark in a green and healthy condition for some months, but when decay sets in they are liable to be seriously infested by the larvae of this Lymexylonid, which lays eggs in the bark. If practicable, logs should be kept in the shade so that the bark does not die. They can also be protected by removing the bark; other boring insects may attack the barked wood, but preliminary observations suggest that they cause only superficial damage. It is possible, however, that deterioration may result from cracking.

Hem Singh Pruthi & Samuel (C. K.). **Entomological Investigations on the Leaf-curl Disease of Tobacco in northern India. V. Biology and Population of the White-fly Vector (*Bemisia tabaci* Gen.) in Relation to the Incidence of the Disease.**—*Indian J. agric. Sci.* **12** pt. 1 pp. 35–57, 1 pl., 5 graphs, 14 refs. Delhi, 1942. [Recd. 1944.]

The five years' study that is the subject of this part of a series [*cf. R.A.E.*, A **30** 457] was carried out in northern Bihar in view of the importance of the Aleurodid, *Bemisia tabaci*, Gennadius, as a vector of the virus or viruses that cause leaf-curl of tobacco and the fact that it has been shown to transmit leaf-curl to tobacco from some of its numerous wild food-plants [*cf.* **26** 242; **31** 357, etc.]. Adults on tobacco paired 2–6 days after emergence, and the females began to oviposit 1–4 days later, laying their eggs singly on the under-surface of the leaves. Tables are given showing records of oviposition in each month from September 1936 to April 1939 and, in an appendix, the meteorological data for the same period. Individual females laid 27–206 eggs in 3–12 days; the greatest number laid in 24 hours was 56. The longest life-cycle recorded occupied 39 days in December and the shortest 11 days in April. Adults usually emerged during the day; the proportion of males to females

was high during March–August, low during September-February and particularly low in November–January. The average duration of life of male and female adults varied from four and eight days, respectively, in April–August to seven and 12 days in November–January.

The adults migrated to tobacco towards the end of September when the seedlings are planted in the fields [*cf.* **28** 2]. Infestation of plants or leaves was unequal, some being entirely free and others fully covered with all stages of the insect. Eggs were found on most of the seedlings in early October and first-generation adults in November, but as development is retarded in December and January, only four or five generations are completed on a tobacco crop up to the end of the season in March, after which breeding continues on other food-plants. The numbers of the whitefly and the incidence of leaf-curl on tobacco were both greatest in autumn, decreased in winter and rose again in March. A list is appended of 101 plants on which *B. tabaci* was found in Bihar, of which 53 showed symptoms of leaf-curl and nine were proved reservoirs of leaf-curl of tobacco. It shows the months in which the whitefly and the leaf-curl were observed, the incidence of both, and whether the leaf-curl was known to be the same as that of tobacco.

From 1·5 to 5·1 per cent. of the pupae of *B. tabaci* found on various plants in November–January were parasitised; the parasites concerned were *Prospaltella smithi*, Silv., *Eretmocerus masii*, Silv., and an undescribed species of the genus *Pteroptrix*, which appeared to be the most numerous. The only other natural enemies observed were a fungus that infested the pupae and an unidentified mite that attacked the eggs.

KRISHNA AYYAR (P. N.). **Biological Control of the Cotton Stem Weevil, *Pempherulus affinis* Fst., in South India.**—*Indian J. agric. Sci.* **12** pt. 1 pp. 58–85, 1 pl., 10 graphs, 23 refs. Delhi, 1942. [Recd. 1944.]

A detailed account is given of work done in 1936–38 on the bionomics, food-plants and parasites of *Pempherulus affinis*, Faust, in southern India [*cf. R.A.E.*, A **29** 515, 521–522; **30** 301, 582]. A survey showed it to be a major pest of cotton in certain districts of southern Madras but not injurious in northern Madras; it was found on other plants in Bihar, Surat and the United Provinces. Its numerous food-plants in Madras [**29** 522] included *Urena sinuata* and possibly *Corchorus trilocularis*. Infestation on seasonal cotton crops in 1935–38 showed an increase as the crop matured, with three overlapping generations from October to March. The second developed in January and February, when the numbers of live insects reached a peak. The subsequent decline in population may be due to increased resistance in the older plants and to the increasing dry heat of the season [*cf.* **29** 515].

Apart from the insect parasites [**29** 521–522; **30** 301] and a Nematode [**22** 270], the only natural enemy observed was the mite, *Pediculoides ventricosus*, Newp., which attacked the immature stages but was scarce in the field. *Spathius vulnificus*, Wlkn., a parasite of *Dinoderus* sp. in bamboo, and *Doryctes* sp., a parasite of Longicorns in *Millettia*, were both imported from northern India, and both were reared on *Pempherulus affinis* and *Hypolixus truncatulus*, F. [*cf.* **29** 268], but attempts to breed them in numbers suitable for release were unsuccessful. Much better results were obtained with *S. critolaus*, Nixon, which is the chief local parasite of *P. affinis* [*cf.* **30** 582]; about 9,000 adults were reared during 1936–38 on *H. truncatulus* and the Bostrychid, *Sinoxylon sudanicum*, Lesne. The life-cycle of this Braconid is completed in about 14–25 days. The female selects active, fairly mature larvae for oviposition and usually lays only one egg on each; the maximum numbers of eggs laid by individuals was 53 and the average and maximum numbers laid per day 2–3 and 7, respectively. The larva feeds externally on the fluid contents of the host. Adults lived for up to 5½ months on a diet of nectar of cotton-flowers.

A small-scale experiment in which *S. critolaus* was liberated on cotton plants infested by *P. affinis* in cages indicated that it will work efficiently if released in adequate numbers under favourable conditions. The hosts in this case were taken from *Triumfetta rhomboidea*, and it was later found that they do not oviposit freely when transferred to cotton, so that few stages suitable for parasitism were present. In discussing the prospects of controlling *P. affinis* by large-scale release of *S. critolaus*, the author points out that the natural rate of parasitism is only about 1 per cent., possibly owing to the inaccessibility of the host within the stem and to the periods in which stages suitable for parasitism are not available. On the other hand, the uneven development of *P. affinis* should produce host material throughout the year and there are alternative hosts on which the parasite could develop. Its greatest emergence period coincides with the first brood of *P. affinis* on cotton, and it completes at least three generations to one of the latter. The capacities of the two species for egg-laying are nearly equal, the sex-ratios in the parasite are about even, and 5–6 per cent. of females are winged forms, able to reach host-larvae in distant plants.

RAHMAN (Khan A.). **Insect Pests of stored Grains in the Punjab and their Control.**—*Indian J. agric. Sci.* **12** pt. 4 pp. 564–587, 2 pls., 9 figs., 8 refs. Delhi, 1942. [Recd. 1944.]

As a result of investigations in 1938–42, a list is given of the numerous insects found in stored grain and Bruchids in stored pulses, with a brief description of each and notes on its bionomics and distribution, and control measures are discussed. These include treatment by heat or fumigation, by mixing inert or poisonous dusts with the grain, or by introducing mercury into it [*cf. R.A.E.*, A **31** 351, etc.]. Details are given of the methods of storing grain in the Punjab and the extent to which they afford protection from pests.

SINGH (R. N.). **Control of the Woolly Aphis (*Eriosoma lanigerum* Hausmann) by spraying and other Methods.**—*Indian J. agric. Sci.* **12** pt. 4 pp. 588–602, 8 refs. Delhi, 1942. [Recd. 1944.]

The results are given of experiments against *Eriosoma lanigerum*, Hsm., on apple in Kumaun (United Provinces) and the Punjab. Complete control under orchard conditions was not obtained with any summer spray, but one containing nicotine sulphate and soft soap was more effective than insecticides that act purely by contact, as it had some fumigant action in hot weather. Winter sprays were also not consistently effective, but 100 per cent. mortality was sometimes obtained with mixtures of resin and soap, particularly when an additional insecticide, such as tobacco extract, was added to them. Soil fumigants were ineffective, except at concentrations that killed most of the trees, and adhesive bands to prevent migration from the roots failed to give appreciable control. Experiments in progress with various imported or local root stocks in the United Provinces indicated that some are almost or completely immune from infestation.

Coccinella septempunctata, L., is a natural enemy of much importance in Kumaun. It practically eliminates the aerial colonies of *Eriosoma* from April to June, inclusive, but tends to disperse to other plants infested with various Aphids during the rainy season, though it persists in small numbers on apple until it enters hibernation early in October. *Eriosoma* increases gradually during the rainy season and becomes very injurious in October and November. Experiments with the imported parasite, *Aphelinus mali*, Hald., have not given promising results in Kumaun; its permanent establishment appears

impossible, owing to the activity of the Coccinellid, and it does not increase rapidly enough to control *Eriosoma* if released late in the season. It is, however, reported to be of considerable value in the Punjab [*cf. R.A.E.*, A **30** 612].

RAHMAN (Khan A.), GURCHAR[A]N SINGH SOHI & AMAR NATH SAPRA. **Studies on stored Grain Pests in the Punjab. II. Biology of** *Bruchus analis* **Fab. and** *Bruchus chinensis* **Linn. (Bruchidae : Coleoptera).**—*Indian J. agric. Sci.* **12** pt. 6 pp. 851–864, 3 figs., 23 refs. Delhi, 1943.

The following is largely based on the authors' summary of this paper, in which are given the results of studies in 1940–41 on the bionomics of *Bruchus analis*, F., and *B. chinensis*, L. [*cf. R.A.E.*, A **26** 7] in the Punjab, where they are the most important pests of stored pulses. They are active from early spring to late autumn and overwinter in the larval stage. The eggs are laid on the seeds, and the larvae bore into the seeds and consume all the contents, pupating next to the seed coat. Only one larva of *B. analis* but as many as eight of *B. chinensis* may be found in a single seed. A female of *B. analis* lays 11–150 eggs in 2–12 days at the rate of 1–82 eggs per day. The egg, active larval and pupal stages occupy from 1 to 18, 8 to 43, and 5 to 36 days, respectively, according to the season, and there are 9–10 overlapping generations a year. A female of *B. chinensis* lays 34–113 eggs at the rate of 1–37 per day, the egg, active larval and pupal stages occupy 4–16, 10–38, and 4–28 days, respectively, and there are 7–8 overlapping generations in a year. The larvae of both species are parasitised by *Bruchobius laticeps*, Ashm.

Tables are given showing oviposition records, the durations of the various stages and of adult life, sex-ratios, and the rates of development of both species in seeds of 11 different pulse crops. In nature both were found in beans (*Phaseolus* spp.) and peas and *B. chinensis* also in gram (*Cicer arietinum*), cowpeas, lentils and *Cajanus cajan*.

QADRI (M. A. H.) & AZIZ (M. A.). **Notes on the Indian Species of Sugarcane Leaf-hopper,** *Pyrilla* **Stål (Lophopinae : Fulgoroidae).**—*Indian J. agric. Sci.* **12** pt. 6 pp. 883–888, 6 figs., 7 refs. Delhi, 1943.

In view of doubt as to whether sugar-cane is attacked by more than one species of *Pyrilla* in India [*cf. R.A.E.*, A **26** 8], material collected in various parts of the country was compared with specimens from Ceylon considered to be *P. aberrans*, Kby. It was found that *P. pusana*, Dist., is specifically distinct from *P. perpusilla*, Wlk. [*cf. loc. cit.*] and that both are widely distributed in India. They were the only species represented in the Indian material. Both sexes of the three species are described.

MANI (M. S.). **Studies on Indian parasitic Hymenoptera. I.**—*Indian J. Ent.* **3** pt. 1 pp. 25–36, 6 figs., 10 refs. New Delhi, 1941. [Recd. 1944.]

Among the new species described are *Hypolethria ramachandrai*, *Telenomus saccharicola*, *Bephratoides saccharicola*, *Euplectrus plecopterae*, *Encarsia isaaci*, *E. muliyali* [*sic*] and *Eretmocerus delhiensis*, of which host records have been cited from subsequent papers [*R.A.E.*, A **31** 358], *Litomastix daccaensis*, which was reared from *Anomis* (*Cosmophila*) *sabulifera*, Gn., on jute at Dacca and is presumably the species subsequently cited as *L. gopimohani* [*loc. cit.*], *Euplectrus gopimohani*, from larvae of *Laphygma exigua*, Hb., at Dacca, and *Aprostocetus krishnieri*, from larvae of *Hypolixus* (*Lixus*) *truncatulus*, F., in stems of *Amarantus* at Coimbatore. The hosts here recorded for *Hypolethria ramachandrai* are Dipterous pupae in dead-hearts of sorghum at Coimbatore and Diptera breeding in decaying tunnels of *Sesamia uniformis*, Dudgn., in sugar-

cane in Bihar. *Lygocerus rufipes*, Thoms., is recorded for the first time from India, where it was reared from the cocoons of a Chrysopid on sugar-cane at Jullundur in 1939. The synonymy of *Dinarmus sauteri*, Masi (*coimbatorensis*, Ferrière) is confirmed [**29** 522].

TASKHIR AHMAD & GUPTA (R. L.). **The Pea Leaf-miner, *Phytomyza atricornis* (Meigen), in India.**—*Indian J. Ent.* **3** pt. 1 pp. 37–49, 1 pl., 9 refs. New Delhi, 1941. [Recd. 1944.]

A leaf-miner that was recorded from crucifers in India in 1906 and has caused severe injury to peas and other plants at Delhi in recent years was identified as *Phytomyza atricornis*, Mg., in 1937. All stages of this Agromyzid are described and its distribution throughout the world is reviewed. In India it is known to occur in Bihar and several places in the Punjab and to attack 29 species of plants, chiefly vegetables and ornamental flowers, belonging to 13 Orders, a list of which is given. The 18 from which it is recorded for the first time include mustard, turnip, lentil, barley, carrot, egg-plant, potato and spinach.

Of leaves of pea plants examined at Delhi in March 1937, 88 per cent. were infested, and there were about 9 larvae, 3 pupae and 11 feeding and oviposition punctures per leaf. Adults that emerged in the laboratory mated after 36–48 hours. The pre-oviposition period lasted about four days, after which eggs were laid almost daily for about a month. The total numbers laid by three females were 329, 355 and 358 [*cf. R.A.E.*, A **23** 506], and the maximum number laid in a single day was 50. The egg, larval and pupal stages were completed in averages of 3·9, 11·1 and 15·1 days at 13–15°C. [55·4–59°F.] and 2·2, 5·2 and 6·8 days at 23–28°C. [73·4–82·4°F.]. The percentages of eggs, larvae and pupae that were viable were 84–89, 51–64 and 70–76, the viability of larvae and pupae being highest at 22°C. [71·6°F.]. Adults without food lived for only two days at 23–28°C., but the average and maximum periods of survival of those supplied with honey or fresh pea leaves were 15 and 29 days at 23–28°C., 61·5 and 86 days at 16–18°C. [60·8–64·4°F.] and 27 and 50 days at 13–15°C. In India, *P. atricornis* breeds mainly in the spring, when the temperature is moderate and the humidity high, and passes the summer and autumn in the pupal stage. The adults generally appear in January, sometimes in December, and food-plants are available by February, when the prevailing temperature is 17°C. [62·6°F.]. At this time, a generation occupies one month, and there are four generations during March and April, when the temperature rises to 23–28°C. In general, aestivation begins in May, but restricted breeding may continue until June in cool districts and on late spring food-plants. In the laboratory, pupation was completed early in June. Some adults must emerge in August, however, as a few larvae were found infesting lucerne at Delhi in September. A Eulophid of the genus *Solenotus* was observed to parasitise the larvae from the end of February onwards. The female deposits 1–4 eggs in the host, and the larval and pupal stages each lasted 4–5 days. Some of the larvae pupated within the host and others outside it.

Control measures comprise the prompt destruction of infested leaves supplemented by adequate irrigation to induce the plants to sprout again, the destruction of alternative food-plants in the vicinity, and spraying with nicotine sulphate and soft soap in water (1 : 2 : 400), which destroys all the immature stages except the advanced pupae and is a temporary repellent.

NARAYANAN (E. S.). **Notes on some Indian parasitic Hymenoptera, with a Description of a new Cynipid.**—*Indian J. Ent.* **3** pt. 1 pp. 59–63, 7 figs., 3 refs. New Delhi, 1941. [Recd. 1944.]

Brief notes are given on the bionomics at Pusa of the Braconids, *Apanteles paludicolae*, Cam., and *A. pusaensis*, Lal. *A. paludicolae* was bred from larvae

of *Sphenarches caffer*, Zell., which is a minor pest of *Lagenaria vulgaris*, *Dolichos lablab*, *Cajanus cajan* and *Cucurbita pepo* in different parts of India [*R.A.E.*, A **25** 530] and attacks the leaves of *L. vulgaris* throughout the year at Pusa. The parasites were present about this food-plant from July until the end of March. The females oviposited only in unparasitised larvae of the Pterophorid, and only one parasite larva occurred in each. The full-grown larva is described. The larval and pupal stages occupied 12 and 6 days, respectively, in July-September, and about 20 and 9 days in winter. In 1933 and 1934, parasitism was highest in December (64·5 and 80·6 per cent., respectively) and in 1935 in November (50 per cent.) ; the lowest parasitism recorded was 22·2 per cent. in March 1935 [*cf.* **19** 395]. *A. pusaensis* parasitised the larvae of *Sylepta lunalis*, Gn., on the leaves of grape-vine, and destroyed 60–70 per cent. of them in July and August. From 20 to 40 larvae emerged from a single host. The pupal stage was completed in 5–6 days in July-August.

Aphidencyrtus aphidivorus, Mayr, a European hyperparasite of Aphids, is recorded for the first time from India, and notes are given on its characters and on those of the genus *Aphidencyrtus*. The Cynipid, *Amblynotus syrphidiphagus*, sp. n., is described from females reared at Delhi from larvae of *Sphaerophoria javana*, Wied., a predator of *Aphis laburni*, Kalt.

Ramakrishna Ayyar (T. V.). **Notes on some South Indian Mealy-bugs.**—*Indian J. Ent.* **3** pt. 1 pp. 107–113, 4 figs., 3 refs. New Delhi, 1941. [Recd. 1944.]

This paper comprises very brief notes on the food-plants, occurrence in India, and, in some cases, the appearance and natural enemies of 26 Dactylopiine and six Monophlebine Coccids.

Trehan (K. N.). **Effect of coloured Screens on Oviposition and Development of some British White-flies.**—*Indian J. Ent.* **3** pt. 1 pp. 121–138, 6 figs., 17 refs. New Delhi, 1941. [Recd. 1944.]

In view of inconclusive results obtained in work on the effect of light and light of various wave-lengths on insects and insect development, which is briefly reviewed from the literature, studies were made in 1936–38 on the influence of coloured light on the development of *Aleurodes proletella*, L., and *Trialeurodes vaporariorum*, Westw. The insects were enclosed in cages made of cellophane of seven different colours and placed over the leaves of seedlings in pots. Oviposition was highest in yellow light, high in white, lower in violet and orange, and lowest in red, green and blue light. The eggs and nymphs developed most quickly in red and most slowly in white, yellow and violet light. The period over which the adults emerged was most prolonged in yellow, white and violet light. As cellophane screens do not ensure monochromatic radiation, the results are best interpreted in terms of the wave-lengths of the light cut off by the different coloured screens, which are figured diagrammatically ; the relative intensity of the radiation transmitted through the screens may also be a factor. The favourable effect on oviposition of the yellow and white screens, and to a less degree of the violet screen, may depend on their relatively greater transparency ; other work on Aleurodids has shown that adults and eggs are most abundant on the leaves that are most exposed to light. Light of medium and long wave-length appears to have a stimulative effect, but this is not apparent in the case of the red screen, which also transmits light of very short wave-lengths that probably counteracts it. These short rays are cut off by the yellow screen, which is transparent to those of medium and long wave-length. The rays responsible for retarding development are probably those with wave-lengths of 450–600

Ångström units, which are approximately those cut off by the red screen. The stimulative effect of this screen may also be due to its relatively low transparency, since in the field the immature stages are known to be most abundant in the middle region of the food-plant. None of the screens prevented development.

Short Notes and Exhibits.—*Indian J. Ent.* **3** pt. 1 pp. 139–143. New Delhi, 1941. [Recd. 1944.]

C. N. Modawal (pp. 139–140) states that in studies on the bionomics of *Chilomenes sexmaculata*, F., which is predacious on various Aphids in India, the adults paired 3–4 days after emergence, but only if they were fully fed. The maximum number of eggs laid by one female in a week was 231. The adults survived 7–14 days with food, but only 4 without. A single adult destroyed an average of 44 individuals of *Macrosiphum avenae*, F. (*granarium*, Kby.) per day. The experiments were carried out at constant temperatures of 50, 64 and 77°F., and at room temperatures with a mean of 68°F. The beetles fed little and did not oviposit at 50 and 64°. A single larva destroyed an average of 456 Aphids at 77°F. and 310 at room temperatures. The egg, larval and pupal stages occupied 1–2, 10–12 and 3–4 days, respectively, at 77°F. and 3–5, 13–15 and 4–6 at room temperatures, and there was a prepupal stage of 24–36 hours. The larvae did not survive more than 4–5 days at temperatures below 64°F.

Mohan Singh (p. 141) gives a list of food-plants recorded for 16 species of Lepidoptera and one Anthomyiid for the first time in India.

R. M. Fotidar and A. P. Kapur (p. 142) report that *Aspidiotus destructor*, Sign., caused serious injury to seedlings of mango [*Mangifera indica*] in several nurseries in southern Kashmir and give brief notes on its bionomics. A local variety of mango was not attacked to any great extent.

A. N. Sapra (p. 142) records that larvae of *Platyedra gossypiella*, Saund., in double seeds of cotton received at Lyallpur from Ludhiana (Punjab) were found to be attacked by *Pediculoides ventricosus*, Newp., which eventually destroyed them. The mite develops best at 27°C. [80·6°F.], and died off in late April or early May at room temperatures at Lyallpur. It also attacks larvae of *Chilo simplex*, Btlr., but those of *Sylepta derogata*, F., are relatively immune.

Gurcharan Singh Sohi (p. 142) states that the egg, larval and pupal stages of *Oryzaephilus* (*Silvanus*) *surinamensis*, L., a common pest of stored products in the Punjab, occupy about 8, 36 and 7 days, respectively. The adults survive for 2–5 months, and a single female deposits as many as 85 eggs. The oviposition period may last 2½ months. The larvae are parasitised by *Cephalonomia tarsalis*, Ashm.

M. A. Ghani (p. 143) records the Tineid, *Psorosticha zizyphi*, Staint., for the first time from the Punjab, where the larvae rolled the leaves of *Citrus* in a nursery in 1940. Two Hymenopterous parasites were bred from the larvae.

Dick (J.). **Two new Insect Pests of Sugarcane in Natal.**—*S. Afr. Sug. J.* **27** no. 5 pp. 212–213, 5 figs., 7 refs. Durban, 1943.

A local outbreak of Noctuid larvae was observed on sugar-cane in Natal in October 1942, but most of them were diseased or parasitised and no adults were reared. Similar larvae, however, hatched from eggs found on sugar-cane leaves in another locality in December, and adults reared from them were identified as *Spodoptera mauritia*, Boisd. Two generations were reared, the egg, larval and pupal stages lasting 4–5, 25–34 and 6–10 days. The moths lived for 10–12 days and began to oviposit 4 days after emergence. The eggs were laid on the leaves in batches of 100–200, and the larvae fed on maize and sorghum as well as sugar-cane. When newly-hatched, they did not readily attack the leaves of

sugar-cane, and field infestations possibly spread from maize, sorghum or wild grasses. Tachinids are probably important parasites of the larvae and pupae, and the Argentine ant [*Iridomyrmex humilis*, Mayr] destroyed the prepupae and pupae. The world distribution of this Noctuid is given ; it is not considered likely to be a serious pest in Natal.

Adults of *Temnorrhynchus clypeatus*, Klug, attacked planted setts of cane for about a fortnight in January 1943 ; they burrowed into the sticks, destroyed or damaged the eyes, and killed many of the young shoots. The larvae probably feed on decaying vegetable matter in the soil and were not found attacking cane. This Dynastid was taken in Natal in 1902, but had not previously been recorded as a pest and would damage sugar-cane only if the setts were in the ground during its relatively short flight period.

PETTEY (F. W.). **Prickly-pear Eradication by Insects and Felling of Plants.**—*Fmg in S. Afr.* 1943 repr. no. 110, 4 pp., 2 figs. Pretoria, 1943.

Though *Cactoblastis cactorum*, Berg, has caused considerable damage to *Opuntia megacantha* in South Africa since it was first liberated in the veldt in 1933, it has not afforded complete control, mainly because it cannot thrive on the woody parts of the plant. Other factors that hinder its progress include the destruction of many young larvae by the mucilaginous sap and of the fully-fed ones by the extreme heat in summer, as well as attack by natural enemies [*R.A.E.*, A **30** 32]. In 1937, *Dactylopius opuntiae*, Ckll., which had been found to thrive on this species of *Opuntia*, was imported from Australia and liberated against it. It had increased sufficiently by the end of 1939 for redistribution to be begun, and by 1943 it was well established in all areas in eastern Cape Province in which *O. megacantha* was reasonably accessible. It was particularly effective in areas 30 miles or more from the coast, but failed to afford complete control if the plants were large, and its increase was checked by the Coccinellids, *Exochomus flavipes*, Thnb., and *Cryptolaemus montrouzieri*, Muls. [*cf.* **30** 563].

Extensive experiments have shown, however, that almost complete control can be obtained in 12–18 months if the plants are cut down when they have been weakened by *Dactylopius* or *Cactoblastis* [**32** 14], and this should be done on all infested land. It has the additional advantage that it avoids the risk of the development of a strain of *D. opuntiae* less toxic to the plant, which might otherwise occur since the most toxic individuals fall to the ground with the leaf-pads they have destroyed and die. The felled plants should not be piled in heaps or burnt, since this increases the cost and kills many insects, which are required to destroy any regrowth that may occur. Under certain conditions, felled branches may take root ; regrowth found after 18 months should therefore be uprooted. Seedlings may appear over a considerable period, since some seeds have remained viable for 15 years, but if insufficient insects persist to eradicate them, they may easily be destroyed by mechanical means.

Notes sur les appâts au son et sans mélasse, pouvant être utilisés dans la lutte anti-acridienne (contre *Schistocerca gregaria* Forsk.).—*Rev. franç. Oranger* **14** no. 147 pp. 94–96. Casablanca, 1944.

To determine the value of molasses in poison baits for locusts, cage experiments were made in Morocco with hoppers of *Schistocerca gregaria*, Forsk., 25–28 days old. The percentages dead after 2 and 8 days were, respectively, 30 and 80 when the bait contained 100 lb. bran, 8 lb. molasses, 4 lb. sodium fluosilicate and water to moisten, 35 and 80 when the same bait was used without molasses, 20 and 50 when it was used without the molasses or water, and 0 and 10 in controls. In an experiment with young adults, which were given cabbage leaves as well as bait, 15 per cent. mortality after 3 days was

obtained from bait containing molasses and water, and 60 per cent. from the same bait without molasses ; in a second test, the respective mortalities were 35 and 45 per cent. Thus moist baits without molasses were equal, or superior, to baits containing it.

Baits lose effectiveness as they dry, but an experiment showed that a bait containing molasses lost 37·21 per cent. of its water content in four days under conditions in which one without molasses lost 37·80 per cent. Thus, molasses has no value in delaying desiccation. By placing samples of dried bait in a humid chamber, it was also shown that molasses has no effect on the absorption of water from the air.

PERRET (J.). **Sur l'utilité de la mélasse dans l'appât toxique employé contre le criquet pèlerin** (*Schistocerca gregaria*, **Forsk.**).—*Rev. franç., Oranger* **14** no. 147 pp. 96–98. Casablanca, 1944.

The small-scale experiments noticed in the preceding abstract were followed by tests on a larger number of hoppers of *Schistocerca gregaria*, Forsk., in free-air enclosures measuring $6\frac{1}{2} \times 13$ ft. In eight tests, consistent results were obtained, with an average mortality after 3 days of 72·38 per cent. from baits with molasses and 72·44 without molasses. A large band of first-stage hoppers, in an enclosure measuring about 40×100 ft., showed 95 per cent. mortality in 4 days from a bait without molasses. Tests on an actual control scale confirmed the results of the experiments.

It is concluded that molasses does not increase the attractiveness of baits, the bran itself being an attractant, but as the tests were made with baits applied in areas with scanty vegetation, it might be well to repeat them where the vegetation is abundant and succulent.

JANNONE (G.). **Trofismo acridiofago di alcune popolazioni africane e suoi riflessi nella lotta contro le cavallette.** [The Use of Acridids as Food by some African Populations and its Effects on the Control of *Schistocerca gregaria*, Forsk.]—*Boll. Soc. ital. Med.* (Sez. Eritrea) **3** pp. 177–206, 19 refs. Asmara, 1944. (With a Summary in English.)

Locust-eating habits of some Eritrean tribes are discussed, and it is suggested that they may contribute to the reduction in the number of locusts during the intervals between outbreaks.

SMITH (W. W.), JENKINS (L.) & HASEMAN (L.). **A Study of Codling Moth Abundance as influenced by Crop Failures.**—*Bull. Mo. agric. Exp. Sta.* no. 472, 11 pp., 2 figs., 1 ref. Columbia, Mo., 1943.

Since most of the larvae of the codling moth [*Cydia pomonella*, L.] in orchards in Missouri develop in apples, few mature in years in which the crop fails ; the measures employed to induce regular bearing have been an important factor contributing to the abundance of this species in recent years. In 1938, late spring frosts caused a complete crop failure in orchards in the south-western part of the State, and the populations of the moth, which had been normal in 1937, diminished during the year and were practically non-existent by September. In the next two years, the trees bore heavy and average crops, which tended to mask the damage due to the gradually increasing number of larvae, and the spray schedules used were lighter than usual ; this, combined with favourable weather, enabled the populations to regain their normal injurious level in three years.

In 1939 about 95 per cent. of the opening blossoms over 75 acres of a 90-acre orchard in north-western Missouri were removed by spraying with 1·7 per cent. cresylic acid, and the remaining crop was removed by hand. The other 15 acres were allowed to bear a crop. No control measures were applied. By October, populations were almost completely eliminated in the section that bore no crop, whereas most of the apples in the untreated part were infested and overwintering larvae were abundant ; there had probably been some flight of moths into this section from the adjoining treated part in the spring. In the following year, the whole orchard bore a crop and was sprayed against *C. pomonella*, the heavily-infested part receiving an extra spray. Adults entered the uninfested part from the infested, but by the end of August had penetrated only 200 ft. The average numbers of hibernating larvae per tree in October 1940 were 53·4 in the section that cropped in 1939, 20·4 in the first three adjoining rows and 12·2 in the tenth row (400 ft. distant). A comparison with the numbers found in October 1939 indicated population increases of 24, 2,000 and 1,200 per cent., respectively ; the high increases in the last two cases are attributed to flight from the heavily infested trees.

In 1941, the bloom on two rows of trees in an orchard in north-eastern Missouri was destroyed by spraying ; these trees had practically no fruit in 1941 and a full crop in 1942. The adjoining rows had practically no crop in 1942. In the autumn of 1942, there were 214 larvae under bands on two of the trees that cropped in that year, and none on two that did not. Similar counts on untreated trees of two varieties in another part of the orchard in 1940–42, inclusive, indicated that the number of hibernating larvae present varies directly with the size of the crop.

FENTON (F. A.). **An ecological Study of *Toxoptera graminum* in Payne County.**—*Proc. Okla. Acad. Sci.* **23** (1942) pp. 14–20, 6 refs. Guthrie, Okla., 1943.

The following is based on the author's introduction and summary. In Oklahoma, infestation by *Toxoptera graminum*, Rond., develops in the late autumn in the form of deadened more or less circular areas in fields of wheat or barley. In the following spring, these areas may enlarge and become confluent, and most of the plants may be destroyed. Moreover, millions of winged Aphids may migrate from these fields to spring-sown oats and destroy them also [*cf. R.A.E.*, A **29** 251]. In some years, as in 1941–42, the fields may be invaded by Aphids drifting from infested districts in Texas, so that more general field infestations develop. In other years, certain conditions, not clearly understood, prevent further development of the Aphid in the spring and little economic loss results.

Infestations in selected wheat and barley fields in Payne County, were studied in 1939–41 to evaluate the effect of parasites and predators [*cf. loc. cit.*] on this Aphid. In two of these years, one species of predator, *Hippodamia convergens*, Guér., was sufficiently numerous to have exerted some effect on the Aphid population, although not enough to control it. In one year, the parasite, *Lysiphlebus testaceipes*, Cress., seemed to have been a very important factor in checking the Aphid ; in another it became abundant only in time to destroy the Aphids remaining late in the period of the infestation. In the two years in which natural enemies were of secondary importance, heavy rainfall appeared to be the principal factor checking the outbreak and was indirectly involved in terminating the infestation in that it promoted rapid growth of the plants, thereby making conditions more unfavourable for the Aphid.

FENTON (A.) & CLARK (S. W.). **The Use of Sulphur in the Control of Truck Crop and Cane Fruit Insects and Diseases.**—85 pp., 214 refs. Houston, Tex., Texas Gulf Sulphur Co., 1943.

This revised edition is similar to the previous one [*R.A.E.*, A **24** 494] in the general scope and arrangement of the subject matter, but the number of crop

plants dealt with is slightly increased, and the section on pyrethrum and rotenone-bearing dusts used with sulphur is omitted, information on this subject being here included in the general text.

MARCOVITCH (S.) & STANLEY (W. W.). **Control of Mexican Bean Beetle and Bean Leaf Beetle.**—*Circ. Tenn. agric. Exp. Sta.* no. 85, [4] pp., 6 figs. Knoxville, Tenn., 1943.

The recommendations in this circular for the control of the Mexican bean beetle [*Epilachna varivestis*, Muls.] in Tennessee by means of an improved form of cryolite are largely similar to those in a previous one [*R.A.E.*, A **24** 297]. The spray and dust formulae now recommended are 3 lb. cryolite in 50 U.S. gals. water applied to small plants at the rate of about 100 U.S. gals. per acre and to large ones at rates of 150–250 U.S. gals., and a mixture of cryolite and wheat flour (1 : 1) used at the rate of 20 lb. per acre. Sulphur, clay, talc or tobacco-dust, but not hydrated lime, can be substituted for flour, and where dusting equipment is not available, a mixture of 1 part cryolite in 4 parts flour can be applied by shaking it from a loosely woven sack. Prompt application of these sprays and dusts are also effective against the bean leaf beetle [*Cerotoma trifurcata*, Forst.], which is the first insect to appear on seedling beans.

BONDAR (G.). **Notas entomológicas da Baía. XIII.**—*Rev. Ent.* **14** fasc. 3 pp. 337–388, 7 figs., 19 refs. Rio de Janeiro, 1943.

In this part of a series on insects in Bahia [*cf. R.A.E.*, A **32** 30], the author deals almost exclusively with Curculionids of the families ERIRRHININAE and BARIDINAE that occur on palms in Brazil, and describes many new species ; he does not consider the genus *Hoplorrhinus* to be distinct from *Celetes*. Most of these weevils occur on native palms, but *Pseudocentrinus lucidulus*, Hust., which develops in the peduncles of *Cocos coronata*, sometimes infests coconut (*C. nucifera*) in the same way. *Tonesia melas*, Boh., frequently occurs in wounds on coconut, and *Parisoschoenus obesulus*, Csy. [*cf.* **30** 425] *P. suturalis*, Csy., and *P. subsimilis*, Csy., are numerous in the female flowers of coconut and *Attalea funifera*, and develop in abortive fruits and in wounds in the peduncles and petioles. *P. subsimilis* also breeds in the pulp of mature fruits of oil palm (*Elaeis guineënsis*) and has been found in the State of Espirito Santo in the stems of sugar-cane. The author also describes a new Hispid, *Himatidium gomes-costai*, which attacks a number of palms, including species of *Phoenix*, and is a potential pest of date palm (*P. dactylifera*), and gives a redescription of the Bruchid, *Pachymerus diospirosi*, Bond., from seeds of a species of *Diospyros*.

PAPERS NOTICED BY TITLE ONLY.

SEN (S. K.). **A Method of cutting Sections of Ticks and Insects.**—*Indian J. Ent.* **3** pt. 1 pp. 51–54, 15 refs. New Delhi, 1941. [Recd. 1944.]

GADD (C. H.). **Does Manuring reduce the Damage caused** [to tea] **by Shot-hole Borer** [*Xyleborus fornicatus fornicatior*, Eggers, in Ceylon] ?—*Tea Quart.* **16** pt. 2 pp. 30–39, 2 graphs, 5 refs. Talawakelle, 1943. [*Cf. R.A.E.*, A **32** 305.]

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